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SWITCHBOARD SIMPLICITY.

The use of high-voltage switches as a necessary accompaniment of the large polyphase generating station of to-day has added a complication to station operation that has placed a problem of no small difficulty before the switchboard designer. We refer to the complication arising in some of the later high-tension switchboards from the inability of the switchboard attendant to tell easily at a glance, without considerable mental effort and without hesitation, just what the connections existing on a board are. This difficulty is one inherent in the use of the enclosed or oil switch. A knife switch with its contacts on the face of the board shows unmistakably its position. The oil switch is operated either by a handle on the front of the board connected to the switch back or below the board, or it is worked by a low-tension switch-operating circuit from a small switch on the face of the board. But the difference in the position of a handle, which indicates whether a switch is open or closed, does not appeal to the eye or mind of a switchboard operator with anything like the clearness that the position of a knife switch on the face of the board does.

While this fact does not make much difference in the case of small or simple switchboards, it demands serious consideration in the case of a large board, where added to this difficulty is that of greater complication. The switchboard attendant cannot have too clearly before his mind the diagram of switchboard connections and the position, whether open or closed, of each switch. The first move in the direction of greater clearness for the switchboard operator was made in the design of the board for the Metropolitan Railway in New York, and a similar design to be used in the plant of the New York Manhattan Elevated Railway, both of which have been described in these columns. The switches controlling the low-tension switch operating circuits are mounted on a bench board, which bears on its surface a wiring diagram. The handles of the operating circuit switches are so included in this diagram as to show at what points the circuit is opened or closed, and the switchboard operator has before him at all times a plan of the switchboard connections existing at any moment.

A still further step toward simplicity and toward aiding the switchboard attendants in keeping clearly before them the relations of the circuits on a board is that outlined in another column as worked out by Mr. R. H. Pierce, of Chicago, for the new polyphase generating station of the Kansas City Electric Light Company. In this case the conditions were considerably different from those in the two plants before mentioned in that the number of generating units is less and the variety of service supplied is greater. In the latter design Mr. Pierce mounts the switches which work the low-tension switch operating circuits directly on the panel which carries the measuring instruments relating to that circuit. Along the face of the row of panels will be run a set of dummy bus-bars, and the operating handles of the switches will be interposed between these dummy bus-bars in such a way as to afford at all times a picture of the connections. While this plan is not as compact as that first outlined where the operating switches are all on a bench board, it has the advantage of having each switch on the panel bearing the measuring instruments in its circuit, and in this respect there is less liability to confusion than where the instruments and switches are on separate boards. This plan, therefore, marks another advance in the direction of clearness and a reduction of chances for dangerous mis-

takes. All efforts in the direction of simplicity and clearness around switchboards of whatever kind cannot be too highly commended, for the necessary complications are great and it takes the best of engineering talent to counteract them.

Current Supply to Large Electric Locomotives.

The discussion of alternating-current motors as against direct-current motors for electric railway service, which has been so prolific lately, has not served to bring out one point which is probably understood by all engineers who have entered the discusston, but which has not been stated in a way to emphasize its importance. The feature of the alternating-current motor to which we refer, is that it enables a high voltage to be used on the trolley line, and that it consequently reduces the difficulty which is sure to be experienced with the current collective devices which large electric locomotives must use. The use of electricity on long-distance lines calls for large locomotives for freight service. For passenger service the trains would, as a result of the change from steam to electricity, be shorter and more frequent than formerly, or, if ordinary trains were used, the mutliple-unit system could be employed for passenger cars and thus the current which would have to be collected for any one car would be relatively small.

The freight business, however, cannot be carried on economically except in large train units. This has been taught by all the railroading experience of the past 50 years. Such large locomotives as are required for freight service presents serious difficulties as to the current-collecting device if the current must be taken from the trolley or third rail at 500 or 600 volts, or even 50 per cent higher. Even at low speeds the collection of sufficient current for an electric locomotive large enough to pull a long freight train, if taken from a third rail by contact shoes, becomes troublesome, on account of the electrical resistance of the sliding contact. What it would be at high speed over long stratches is a matter of surmise, but it should, of course, be much worse than at slow speed, because of heat of friction added to the $I^2 R$ heating. To make practical the operation of such locomotives it seems almost imperative that the voltage must be very materially increased on the trolley or conductor rail in order to reduce the volume of current which must be collected by the contact device, whatever that device is. Any material increase in the voltage employed on a direct-current railway motor seems almost out of the question on account of the commutator troubles that will arise. The use of alternating-current railway motors which would make it possible to carry a voltage of several thousand volts on the trolley line would enable the weight and size of trolley conductors and contact device to be reduced to feasible limits. This appears to be one of the strongest practical points in favor of alternating-current motors for certain classes of railway work involving long distances and high speeds, and where a large amount of power in one locomotive is required.

Standards of Light.

In spite of the general advance in the precision of physical measurements and the standardization of physical quantities, the first year of the twentieth century is drawing to a close with standards of light and illumination in as unsatisfactory a state as could well be imagined. It is not putting the case too strongly to say that the art of illumination is without an absolute standard, without a definite relative standard, and without accurate knowledge of the relations which exist between the tentative working units which have come into use. That such is the case is a reproach to applied science. There is not even a general concurrence as to the terms in which artificial lighting and lights should be defined. If in terms of the intensity of the radiants, one set of difficulties is encountered; if in terms of luminous flux, another. Back at the very root of the matter lies the fundamental difficulty that the thing in itself is not measurable in the same sense as length and time and mass, but involves physiological variables. It is precisely comparable to the kindred acoustic conditions. Suppose for the moment that sound were a saleable commodity, its value depending on its pitch and loudness, and imagine the confusion that would result from attempts to come to a common basis of reckoning. In face of the physiological facts it must be admitted that there is small hope of establishing a thoroughly scientific system of measurements, interconnecting the subjective and the objective. But a consistent empirical system is far better for scientific purposes than none at all, and for practical operations often quite as convenient.

The only step taken towards the establishment of an absolute luminous standard, the Violle platinum unit, has up to date led to no useful result. Cleverly conceived as it was, its only practical result has been the tentative introduction of the *bougie décimale* as a new and confusing empirical standard. Incidentally it has encouraged the formation of a tentative terminology used just enough to be continually under foot, so to speak. As a matter of fact, there are in common use in this country three standards of luminous intensity. First comes the worthy and unreliable English candle, the only one of the three which has any legal rights. Second is the *bougie décimale* much affected by advanced scientific writers who would like to use it practically if they could find it; and, finally, the Hefner unit, widely used because certified standards are easily attainable, but purely empirical and bad in color. Likewise we have the derived units of illumination the candle-foot, an unholy alliance of a pair of empiricals without scientific standing, and the *bougie-metre* or lux. Also one might add the Hefner-anything-you-please to the list. Really the situation would be amusing if it were a bit less serious, particularly if one remembers that the relation existing between the three units is only roughly known and that they have distinctly different colors.

It is a bad scrape, and the puzzling thing is to find a way out. The fundamental difficulty is that light in its practical relations is a sensation not a physical quantity that can be defined in ergs. It seems to us, therefore, that the very first step is to settle upon a conventional standard selected purely for its physical merits. The Hefner unit is excellent in some respects, but is too small and too red for easy comparison with modern radiants. Until such an empirical standard is devised and accepted attempts at a connected system of units are futile and premature. The primary standard question needs thorough overhauling before anything further is done. In most instances the thing which has to be measured is intensity of illumination, but the definite and steady source has to come first. When that is available the unit-meter will very satisfactorily express the practical illumination at any point. Luminous flux and its time derivatives are not things to be measured directly unless in photographic researches for which the ordinary luminous standard may or may not prove useful. It is conceivable that for actinic purposes the active radiation might be expressed in absolute units with a precision far greater than can be attained in photometry. Indeed, the advances in orthochromatic photograhy might evolve a satisfactory way of determining in absolute measure the relative intensities of radiation of visual usefulness. But the crying need at present is for a general and authoritative agreement as to the principal unit—that of intensity. We applaud the ingenuity displayed by Blondel and other

recent writers in planning a logical nomenclature for the branch of science under discussion, but the Violle standard on which such work has been uniformly based is altogether too far from general acceptance and from common utility to furnish a sound basis for one unit, let alone a half a dozen. The case is one for international convention, which we earnestly hope will not be long wanting.

THE STANDARDIZATION OF ELECTRIC APPARATUS.

An article on this subject, in the November number of the *Engineering Magazine* calls attention to the commercial importance of standardizing electrical machinery, both to the manufacturer and the purchaser. Some of the standard pressures and frequencies of alternating-current circuits recommended in the rules of the American Institute of Electrical Engineers are also quoted. These rules have now been outstanding for more than two years, and it is likely that they will require some slight modification from time to time as the industry advances. It is only reasonable to expect that progress and developments in manufacture should call for corresponding improvements in standardization. In a paper presented before the International Congress of Engineers at Glasgow last September, Mr. Kapp drew attention to the desirability of the systematic standardization of electric apparatus. The Association of German Electrical Engineers has appointed a committee upon this subject, and the recent report of that committee has been provisionally adopted. It resembles to some extent the report of the Standardization Committee of the A. I. E. E., but differs therefrom considerably in some directions.

The German committee divides machines sharply into three classes with respect to rating, namely: (a) Machines for intermittent service; (b) machines for short duration of service; (c) machines for continuous service. In the first class, it is required that the maximum limiting temperature elevation shall not be exceeded in a full-load test of one hour. In the second class, the same limiting temperature elevation shall not be exceeded in a period which is left open to the manufacturer to declare, but which may conveniently be made two hours. In the third class, the machines shall not exceed the temperature limitation under continuous full load, as determined by tests of sufficient duration. The temperature elevations are stated as follows: For coils of cotton-covered wires, 50 degs. C.; for coils of paper-covered wires, 60 degs. C.; for coils of mica-coated wires, 80 degs. C. Stationary coils are allowed to exceed these limits by 10 degs. For railway motors the corresponding three temperature limitations with one hour's shop test are 70 degs, 80 degs. and 100 degs. C., respectively.

We think that in some respects the above classification of temperature elevations is superior to that of the A. I. E. E. Thus, the differentiation between cotton, paper and micanite insulation is very reasonable and attractive. On the other hand, we think that the A. I. E. E. rules are superior in regard to the method of determining the temperature elevation, which is taken on the basis of direct-current measurements of resistance in coils on both fields and armatures, whereas the German rules seem to be based entirely on thermometer readings, except in the case of the field coils of direct-current machines. We think that measurements should always be made both electrically and thermometrically, and that the two should agree fairly closely, and be mutual checks upon each other; but of the two, the electric method is both more reliable and more nearly accurate. Moreover, the A. I. E. E. rules introduce an important correction for the temperature of the surrounding air above which the elevation is observed, and no such correction appears in the German rules. We also think that the German rules are open to criticism in several minor points. Thus, they recommend the rating of motors in *horse-power*.

Now, it is true that for commercial reasons a motor often has to be rated in horse-power. But the horse-power is a very crude and unsatisfactory unit of power, viewed from the standpoint of the electrical engineer, and we think that the rules of an engineering body should be framed in more scientific fashion so long as the science does not hinder commercial practice. There can be no harm in rating motors in kilowatts like all other electric apparatus, even if they are sold on a horse-power basis; and, at all events, there is no reason whatever for insisting upon the rating of motors in so crude a manner, for the purpose of electrical testing and comparison. One might as well insist upon having dimensions of machines expressed in inches. There seems to be no reason why a direct-current machine should not be rated either a 100-kw generator or an 80-kw motor. We think that the time-test rating for short-duration service should be definite, and not left open to the manufacturer. The time of full-load for limiting temperature should be one hour for intermittent service, and, say, three hours for short duration service. At all events, if the duration in the latter case is left open to choice, much of the value of the classification disappears. If the manufacturer states the power which a machine can develop without exceeding the temperature limitation (a) for a one-hour run, (b) for a three-hour run, and (c) for continuous service, the temperature elevation in any other interval of time, such as two hours, or six hours, can be fairly well estimated by the engineer.

Taking the German rules as a whole, they are sufficiently nearly in accordance with those of the A. I. E. E. to show that both sets of rules have been carefully framed. Moreover, the differences between their respective provisions are often arbitrary, and such as could readily be annulled by mutual agreement. We hope that before long it will be possible for electrical engineers all over the world to unite and agree upon an international set of electrical testing rules. Even if it were not possible to agree upon everything, and certain differences might necessarily appear, due perhaps to climatic influence on the operation of machinery, yet it would be worth while adopting an international code of rules and standardization ratings which all could agree upon and leave the outstanding matters to be adopted locally in each country. We think that this matter might well receive the attention of the various institutions of electrical engineers, such as those in Great Britain, France, Germany and the United States, without delay, and we believe that if the A. I. E. E. were to broach the subject of international electrical standardization, the kindred bodies of engineers across the Atlantic would gladly acquiesce. It would probably be necessary to appoint an international conference upon the subject in connection with some European congress or world's fair, since it would be very difficult to adjust differences of opinion by correspondence. There seems to be no reason why electrical machines should not have the same rating, and the same method of determining that rating all over the world. It is, for example, unreasonable that a 50-kw machine in one country should be regarded as a 60-kw machine in another country, and there is no reason to suppose that a uniform method of rating and testing would create any hardships upon manufacturers in any one particular country. In fact, the cordiality with which American manufacturers have received the A. I. E. E. standardization rules clearly indicates the value to the industry of such a code, and we cannot see that this value would be any less if a code had an international instead of national acceptance.

Proposed American Electro-Chemical Society.

A meeting was held on Nov. 1 at the rooms of the Engineers' Club, in Philadelphia, to discuss the question of the advisability of organizing a national electro-chemical society on the same general plans as the American Chemical Society and the American Institute of Electrical Engineers. Some twenty or thirty persons from different parts of this country who were thought to be interested in the subject of electro-chemistry had been asked to be present or to express their views by letter. Among the communications received the majority, specially from the electro-chemical industries, were in favor of the formation of such a society; the minority thought the time had not yet come for such a society, that the American Chemical Society and the American Institute of Electrical Engineers filled the needs, that there were already a number of other societies at which papers on this subject could be read, etc.

Those present included representatives from New York City, from the Cornell, Lehigh and Johns Hopkins universities, from the American Chemical Society, the American Institute of Electrical Engineers, the Franklin Institute, etc. Professor J. W. Richard, vice-president of the American Chemical Society, acted as chairman and Carl Hering, past president of the American Institute of Electrical Engineers, as secretary. All those present were heartily in favor, the only doubt expressed was whether a sufficient number of members could be obtained to make such a society a success. A committee was appointed, with Dr. Chas. A. Doremus, of the College of the City of New York, as chairman, to canvass for members, and if 75 or over pledged themselves to joint, the society will be formed. In that case, certain committees which were appointed will arrange for holding a formal meeting, at which the society will be founded, and papers read and discussed. Anyone desiring to become a member is asked to communicate with Dr. Doremus, at the above address.

It was furthermore decided to be the expression of those present that the name of the organization should be the American Electro-chemical Society; that the dues should not exceed $5 per year, and that at first only a few meetings of a few days each should be held per year, and that they be held in different cities, as the society is to be a national one.

The fact that papers on the subject of electro-chemistry are now scattered over a half dozen or more existing national societies was thought to be in itself a very good reason for bringing them all together into one, where they could then be properly discussed, which is not now the case. Attention was also called to the fact that the annual electro-chemical products of this country already amounted to nearly $100,000,000, which is far greater than in all the other countries combined. Germany, which comes next with $14,000,000, has a flourishing electro-chemical society with about 40 members in the United States.

Electrical Engineers of the Day—XIX.

CARYL D. HASKINS.

Caryl Davis Haskins was born in Massachusetts in 1867 and obtained his early education in the public schools of Philadelphia and Dedham. In 1879 he went to England and attended the Allison Towers and Roslyndale schools, devoted to the preparation of boys for military and engineering work. Later he studied under the London University tuition system about a year, but finally gave up the idea of a university course and returned to the United States, where he took up the study of biology. This was in 1887, and in the same year he again returned to England and entered the employ of Haskins, Davis & Company, of London, from which engagement the commencement of his technical work dates. After about six months, during which time he specialized on gas engine work, Mr. Haskins entered the shops of S. Z. de Ferranti. Commencing at the lowest round of the ladder, he was advanced to the meter department, of which he became foreman; during this period he was also connected with some of the early work at the old Grosvenor and Deptford stations.

Returning again to the United States, Mr. Haskins, in 1889, entered the employ of the Thomson Electric Welding Company, at Lynn, Mass., in the capacity of designing draftsman, but was almost immediately transferred to the Thomson-Houston Electric Company as assistant foreman of the meter department at Lynn. Shortly afterward he was transferred from the shop and given charge of the company's outside meter interests. The consolidation resulting the formation of the General Electric Company gave Mr. Haskins another promotion and placed him at the head of the meter interests of the consolidated company. In 1893 he was given, in addition, charge of the company's instrument department. In 1900 his responsibilities were again enlarged by including the switchboard department, which appointment necessitated his removing his office from Boston to Schenectady.

While Mr. Haskins is professionally best known as a meter expert, he has been an inventor in several branches. Among almost a score of patents granted to him are included the subjects of steel refining, meters, transformers, switches, circuit-breakers, time relays, etc. Perhaps his most important invention, as well as the most ingenious, is an auto-dirigible torpedo. For obvious reasons, the principles of this torpedo have never been described in print. It has, however, been inspected and favorably reported upon by a special naval board, of which Captain (now Admiral) Sampson was president. Mr. Haskins has refused advances from foreign powers relative to this invention. During odd hours, Mr. Haskins has found time to devote to literary work. In 1892 he became the author of a book on transformers, which answered an excellent purpose in its day when printed information on this subject was very meagre and eagerly sought. Of an entirely different nature is a book entitled "For the Queen in South Africa," a work of fiction consisting of six war stories. Mr.

Haskins has also been a contributor to the *Transactions* of the American Institute of Electrical Engineers, the National Electric Light Association, the Association of Edison Illuminating Companies, the American Street Railway Association, the Northwestern Electrical Association and other electrical organizations. He has also contributed many articles to the periodical press, and has lectured on electrical technical subjects, torpedo warfare, coast defense, etc.

Most of Mr. Haskins' ancestors from the time of the Revolution down, have borne arms in defence of the flag, and with such forebears it was but natural that when a rupture with Spain seemed probable Mr. Haskins should promptly volunteer his services to the Government. Having submitted a plan for raising a volunteer corps for submarine mining, coast and harbor defence, he was summoned before the Chief of Engineers, and his plans were approved. Upon his return to Boston he raised a battalion of electricians, numbering 160 men, immediate command of which body was given to him. This battalion was the first volunteer organization called out for military duty in connection with the Spanish War, and was quietly at work some 10 days before war was declared. Among other things, it mined Boston Harbor, installed searchlights in the harbor system of fortifications, erected and cared for a system of range and position finders, put up telephone and telegraph lines and planted submarine mines. In an official report made by an army officer and forming part of a Congressional document (H. R. 364) it is stated that "When the order to plant the mines was received, the corps was called out and rendered most faithful and loyal service. The result was a torpedo defence in Boston Harbor with great actual as well as moral strength."

Mr. Haskins is a member of the American Institute of Electrical Engineers and of a number of other technical bodies.

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The New Bell Telephone Exchange, Cortlandt Street, New York City.

FIG. 1.—BREASTPLATE TRANSMITTERS.

ON Saturday night, Nov. 2, the New York Telephone Company calmly and deliberately dumped $400,000 worth of telephone apparatus into the scrap heap and started at Cortlandt Street a new exchange in place of the old one, a change representing all told there over half a million dollars, in order to increase the efficiency of its service. The salvage from the old board and the old subscribers' equipments is far too small to be mentioned, but the New York Telephone Company has always been profuse in its expenditures on new and improved equipment, and the opening of the new exchange at "Cortlandt" represents its latest step in a transformation which in the aggregate runs into millions of dollars. The change on Saturday night was made very quietly, in the presence of experts and newspaper men; and very few of the ten thousand subscribers served by "Cortlandt" in using the service this week are aware of any change except in the quickening and improvement generally of the service, under the new "common battery" regime, with lamp signals on the switchboard in place of the "drops."

It appears from the records that the first common battery exchange in New York City was opened at Harlem in November, 1898. Since then exchanges on the new system have been built at West 89th Street (Riverside), East 79th Street, 58th Street (Columbus), 38th Street, 29th Street (Madison Square), 18th Street, Spring Street, Franklin Street, John Street and Broad Street. This work has involved the building anew in every detail of each exchange plant, new buildings in many cases, and alterations to others, much work to the underground cable system, and the re-equipment of every subscriber's station. While this work has been in progress the various reductions in rates have given a marked increase to the number of subscribers, so that in three years the New York Telephone Company has reconstructed its entire plant and added at the same time 40,000 stations to its Manhattan system, bringing the number up from 26,000 in November, 1898, to over 66,000 in November, 1901. It is now by far the largest city telephone system in the world. The Borough of Manhattan alone has more telephones in service than London and Paris together.

The original "Cortlandt" exchange, which went out of business last Saturday, was put in operation Oct. 28, 1888, and served a few days over thirteen years. It is still in sound working order, and is replaced simply because a better system has been invented. At the time the old switchboard was built it was the largest metallic circuit multiple switchboard in the world. It was equipped for 6,000 lines, and for some years served a district comprising the whole of Manhattan Island south of Canal Street. Now there are three other exchanges in that district, and nearly ten times as many telephones in use to-day as there were ten years ago.

Telephone headquarters in New York occupy one of the largest blocks of real estate in the city, with an arcade from Cortlandt Street to Dey Street. The new exchange occupies the entire ninth floor of the Cortlandt Street building and three floors of the new wing of the building. The ninth floor was recently added to the building—originally only eight stories high—for the accommodation of the handsome new switchboard. The operating room is U-shaped, 67½ feet wide at the widest point, 128 feet long in the west wing, and 105 feet long in the east wing. A new wing, recently added to the Cortlandt Street building, contains the cable terminals, distributing frames for connecting subscribers' lines to the switchboard, power plant, storage battery and other auxiliary apparatus. The switchboard is 256 feet long, and consists of 48 sections, end to end. Thirty of these are known as subscribers' sections, and at these are handled all the calls made by "Cortlandt Street" subscribers. The other 18 sections in the eastern run of the board are known as "incoming trunk" sections, and handle calls made by subscribers at other exchanges for subscribers connected to Cortlandt Street. The telephone service of a large city is necessarily worked on a double-track system. Each exchange in the system has many outgoing trunk lines to carry messages to subscribers connected to other exchanges, and many incoming trunk lines to receive messages from other exchanges. These trunk lines, which are wholly distinct from the subscribers' lines proper, aggregate many thousands of miles of wire. The Cortlandt Street exchange is equipped with 1,000 incoming trunk lines and 840 outgoing trunk lines. The switchboard has a capacity for 9,000 subscribers' lines, and each of the 36 sections of the switchboard contains 9,000 multiple jacks or switches.

As already noted above, the new Cortlandt Street exchange (Fig. 2) is operated on what is known as the common battery system, and, being the largest, is the last of the New York Telephone Company's exchanges to be converted from the old magneto system. Details of the method are familiar to our readers. The new subscribers' set consists simply of transmitter, receiver and call bell, with a switch operated by the hand telephone or receiver. When the receiver is taken off the hook the exchange is automatically signaled by the lighting of a small

FIG. 2.—INCOMING TRUNK AND SUBSCRIBERS' SECTION, CORTLANDT CENTRAL BATTERY BOARD, NEW YORK CITY.

incandescent lamp placed immediately below the "answering jack," or switch, by which the operator connects to the subscriber's line to ascertain his wants. When the operator puts her plug into the answering jack, the signal lamp is automatically extinguished. With the

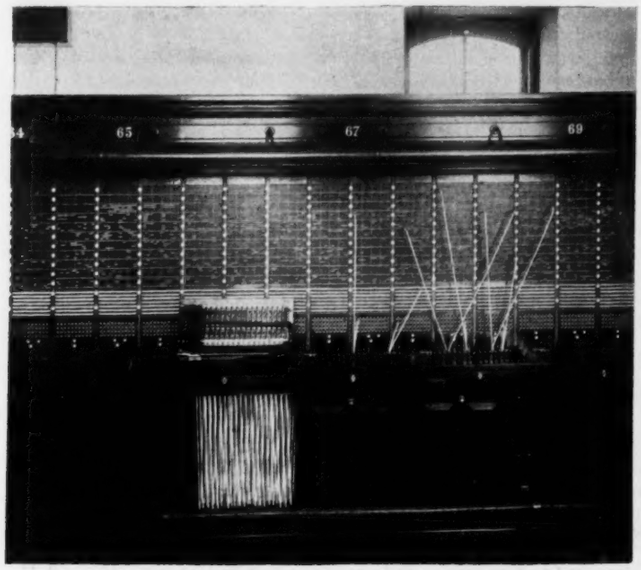


FIG. 3.—FACE OF MULTIPLE SWITCHBOARD, SUBSCRIBERS' SECTION.

second plug of the pair she connects to the line of the subscriber wanted, or to a trunk line if that subscriber is in one of the other exchanges. The connection is then governed by two lamps adjacent to the cords by which the two lines are joined. As long as these lamps are extinguished the two subscribers have their receivers off the hooks and are using the line. When both subscribers hang up their receivers, the two lamps light up, and that is a signal to the operator to take down the connection. This automatically extinguishes the two disconnection lamps. The subscriber, therefore, signals the exchange simply by taking the receiver off the hook and by replacing it. He has

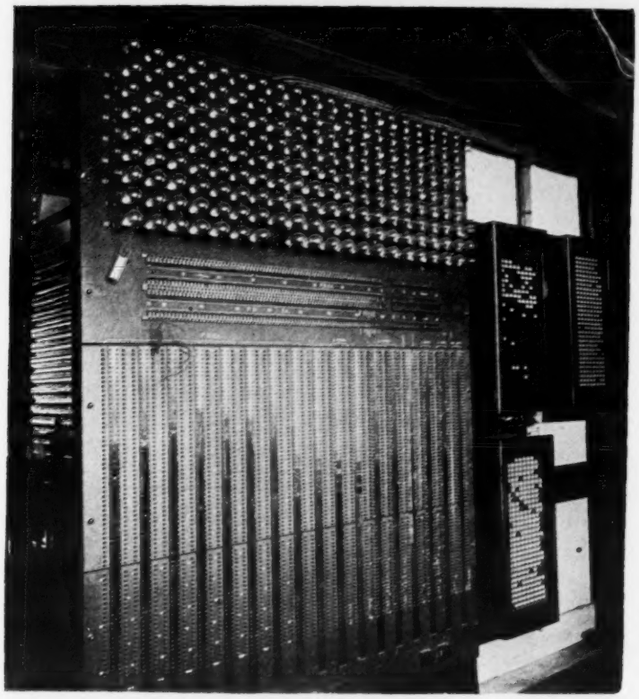


FIG. 4.—FUSE PANELS; ALARM INDICATORS AT RIGHT.

no generator to turn for calling and "ringing off," and the operator has no indicators to restore, and does not have to supervise each connection to make sure that subscribers have not finished their conversation and forgotten to ring off.

Aside from the board, there are many features of interest in the exchange. In the new wing of the Cortlandt Street building are placed the storage battery, the distributing frames, the relay racks, the power plant, the wire chief's desk and other auxiliary apparatus, Figs. 4 to 8. All this machinery occupies three floors, each 44 feet by 22, but it is grouped at very close quarters, not an inch of floor being wasted. Seven

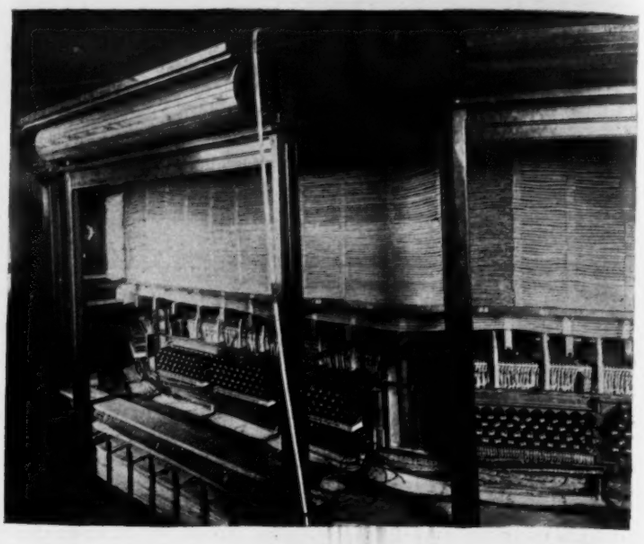


FIG. 5.—BACK OF SWITCHBOARD.

Western Electric motor generators, aggregating nearly 50 horse-power in capacity, are used for furnishing current for charging the "Chloride" storage battery and ringing and testing current. Owing to the constant changes among the users of the service a flexible link between the subscriber's lines and the switchboard wires is absolutely necessary. This is provided by the usual distributing frame or rack. The underground wires are all brought in lead cable to fixed terminals on one side of this frame, and the switchboard wires to fixed terminals on the other. This distributing board has a capacity of 20,000 lines. An intermediate distributing frame on the same general principles permits of grouping the subscribers' lines in the switchboard so as approximately to equalize the work at the different positions. The

FIG. 6.—END OF INTERMEDIATE DISTRIBUTING FRAME.

use of the service varies widely among different subscribers, and it is often necessary to rearrange the groups of answering jacks to prevent certain positions from being overloaded.

"Cutting in" a new exchange is an interesting but not sensational

performance, although in physiology it would be equivalent to connecting up a man's whole nervous system with a new brain. There were between 8000 and 9000 lines, and 9300 subscribers' stations involved in this transfer. Up to the time the service was taken up by the new switchboard, the lines had branches connected to both switchboards. The circuit of each line to the new switchboard was kept open, however, by the insertion of an insulating block in certain spring contacts on the distributing frame. The transfer was effected by taking out these insulating blocks, thus allowing the circuits to the

FIG. 7.—CABLE TURNING SECTION.

new switchboard to become complete, and then cutting off the branch from each line running to the old switchboard. The actual work of effecting the transfer occupied about six hours. A few lines of subscribers who use the service largely at night, such as newspapers, were cut into the new switchboard in advance of the general transfer.

The new switchboard contains over 470,000 spring-jacks or switches, and nearly 14,000 incandescent lamp signals. Each spring-jack and each lamp and its controlling relay is connected to the circuits by several wires and all connections are soldered for greater security. The number of soldered connections in the exchange rune well up into the millions. Each operator is provided with her individual telephone set consisting of breast plate transmitter and head receiver. The total

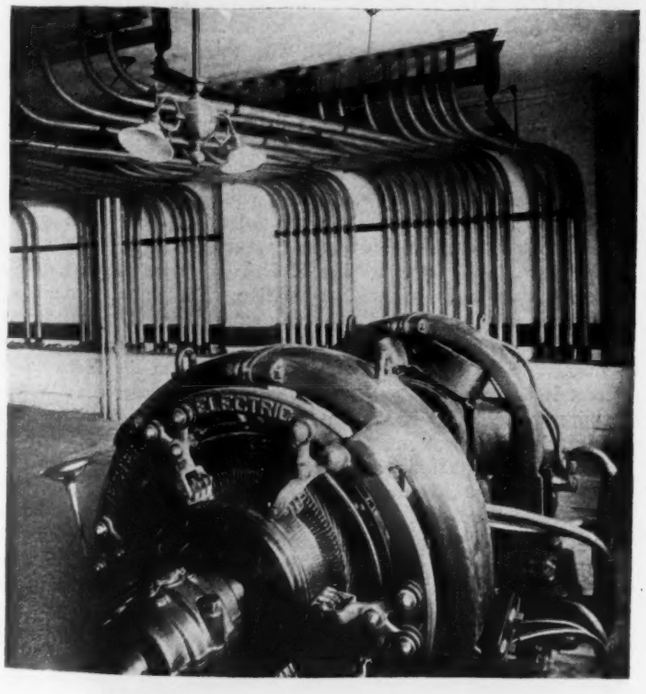


FIG. 8.—PART OF POWER PLANT AND CABLE TERMINALS.

number of operators' positions at the switchboard is 126. The compactness of the new board is indeed striking, the multiple jacks in the board being reduced, it would seem, to the practical limit of minuteness. One interesting feature in the board is the frequency of white lines of varying lengths under the multiple jacks. These signify that the jacks so underlined connect with wires that all terminate at the same point, and the operator, finding the first line "busy," tries the second, and so on. At the subscribers' premises these lines terminate in the private branch exchanges, which are now becoming so numerous in large and active business establishments.

The usual care for the staff is shown in the new exchange. The

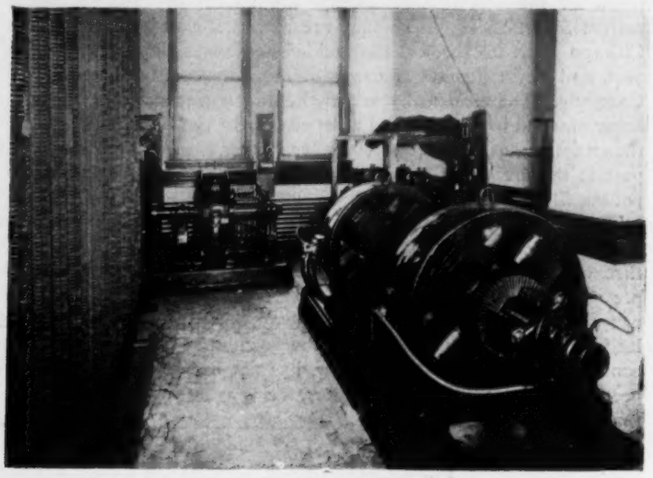


FIG. 9.—PART OF GENERATING PLANT.

operators' quarters occupy the entire ninth floor of the Dey Street building and comprise a spacious locker room equipped with sanitary wire-netting lockers, a large dining room, where tea, coffee, etc., are provided by the company, a sitting room provided with newspapers and magazines, a sick-bay, lavatory, etc., the whole in charge of an experienced matron.

On Saturday night last the New York Telephone Company provided a collation and was represented by many members of its staff, including Messrs. Bethell, Carty, Thurber, Webb and Cox, and Brooklyn was represented by Messrs. Sargent and Reilly, of the New York & New Jersey Telephone Company. The switchboard, etc., was furnished by the Western Electric Company, who were represented by Messrs. Thayer, of New York, and Patterson, of Chicago. All visitors invited were escorted by experts of the company, who explained with great care all the technical points of interest. One notable feature is the exquisite care and thoroughness with which the wiring has been done. The treatment of the cables in the cabinet where the lines from the subscribers' sections and those of the "incoming trunks" come together, over the doorway leading to the distributing frames and power plant in the new wing (Fig. 7) is a thing to be seen to be appreciated. We have never seen a more symmetric and successful piece of work of this kind.

Telephone Competition in New York.

Justice Clarke, in the New York Supreme Court last week, reserved decision upon an application made for the Atlantic Telephone Company for a writ of peremptory mandamus to compel Henry S. Kearny, as Commissioner of Public Buildings, Lighting and Supplies, to permit the company to use the subways of the Empire City Electrical Subway Company (Limited) wherever they exist or wherever they may be built in the future for the purpose of stringing wires. The company also wants permission to erect poles and string wires wherever the subway does not exist. The Atlantic Telephone Company is said to be owned by Senator William A. Clark and Col. Robert M. Thompson, of the Orford Copper Company. The officers of the company assert that they already have 65,000 subscribers enrolled who will take their service for at least five years. The company propose to spend $1,500,000 if they get the permits they are after. They will have eight exchanges in the boroughs of Manhattan and the Bronx, and will make an annual rate of $40 a year to subscribers. Public service rates will be fixed at five cents per call and proportionately low rates will be made on long-distance lines. Objection is raised that the present subways could not take care of any such number of lines and that the company is a "mushroom."

Important Power Station Work at Kansas City.

SINCE the acquirement of the Kansas City Electric Light Company, by stockholders interested also in the Metropolitan Street Railway, of Kansas City, a remarkable development of electric lighting business in that city has taken place. It is seldom that an electric lighting company can record such a growth of business as has been experienced there, and the expedients that have been resorted to in order to take care of this rapid increase of business form an interesting chapter in engineering work. The consulting engineers for the Kansas City Electric Light Company and the Metropolitan Street Railway Company are Pierce, Richardson & Neiler, of Chicago. Mr. Richardson has resided in Kansas City for some time past, and is the general manager of the Kansas City Electric Light Company. The electrical work in the new power stations which are being planned is being looked after especially by Mr. Pierce, while in the steam engineering department Mr. Neiler has had the most active part in the design. Charles Grover is the electrician of the Metropolitan Street Railway.

The Kansas City Electric Light Company is now building a large alternating-current plant from which distribution will be made through sub-stations. This is on the Kaw River almost opposite the present direct-current plant of the Metropolitan Street Railway Company. The Metropolitan Street Railway Company is also to erect a large polyphase generating plant, the machinery for which has been contracted for. The site, however, has not been selected. It is expected that these two polyphase generating plants will exchange current as the necessity arises, and they are, therefore, both being designd for 25-cycle, 6600-volt, three-phase machines.

The adoption of the low frequency for electric lighting service is in this case no serious drawback because the greater part of the output is through a direct-current Edison three-wire network, which must be fed by rotary converters or motor generators, whatever the frequency. The machinery contracted for by the Metropolitan Street Railway includes three 3500-kw, 25-cycle, three-phase, 6600-volt generators, of General Electric manufacture. The station will be designed for three more of these units. Each of these generators will be direct connected to cross-compound condensing vertical Allis-Chalmers engines. These engines are somewhat similar to those in the Metropolitan Street Railway's Ninety-sixth Street power house, in New York, but the area of the low-pressure cylinders is considerably larger. These engines will have 46-inch high-pressure and 94-inch low-pressure cylinders, with 60-inch stroke, and will run 75 r. p. m. At 175 lbs. steam pressure they will develop at an economical cut-off, 5200 horse-power, or 4600 horse-power at 150 lbs. steam pressure. The plant will probably be started at the latter pressure.

The Metropolitan Street Railway Company will also use in its new plant 18 Babcock & Wilcox water tube boilers of 500 horse-power each, with Green Engineering Company's traveling link grates. The Kansas City Electric Light Company will put in at first three 1500-kw, three-phase, 25-cycle, 6600-volt General Electric generators direct connected to Allis-Chalmers vertical cross-compound condensing engines running 75 r. p. m. These engines have 32-inch high-pressure and 72-inch low-pressure cylinders with 48-inch stroke and are rated at 2250 horse-power, with 175 lbs. of steam. The station is designed to contain five units of this size, or two more than are first being installed. This station will have the distinction of having the largest surface condensers ever put in for central station service. Each of these two condensers will have 8000 square feet of heating surface. The condenser tubes are to be 1½ inch in diameter.

The use of surface condensers in this plant rather than jet condensers was considered advisable because of the very poor quality of the Kaw River water, which has a great amount of solid matter, not only in solution but in suspension. The proximity of the Kansas City Stock Yards naturally does not improve the quality of the water at this point as a great deal of the refuse matter from the Stock Yards is discharged into the river near by. The Metropolitan Street Railway power house, which is in operation on the other side of the river, one day was obliged to shut down its condensers through a stoppage in the water supply pipe. Upon investigation it was found that a good-sized hog had found its way into the suction. By use of separators the oil will be taken out of the exhaust water going from the condensers so that it can be used again for feed water, and it is expected that very little city water will be purchased for boiler feeding purpose. The importance of surface condensers for a location such as this, where the water used in condensing is not fit for boiler feed, can be easily appreciated.

Although electric auxiliaries will not be used to any extent since the consulting engineers do not believe that, when the interest on the total investment is considered, electrically-driven auxiliaries are any saving over steam-driven auxiliaries, the two centrifugal pumps which are to raise the river water supplying the water condensers will be driven by synchronous motors. These are well adapted to the purpose, since the speed and load will be constant, and they will not need to be started or stopped frequently. The boiler plant for this electric light power house will contain eight 500-hp Babcock & Wilcox water tube boilers with Green Engineering Company's traveling link grates.

SWITCHBOARD ARRANGEMENT.

The switchboard for this station has been a matter of very careful study on the part of Mr. Pierce, who has had to consider not only the latest advance in the art, but also the special conditions at Kansas City. The result has been a type of switchboard, which differs from anything previously designed, and which marks the latest advance in switchboard construction. In designing this switchboard the General Electric Company's electrically-operated oil switch, such as is being put in the Manhattan elevated power house at New York, is to be used. Instead, however, of having a dummy bench board in front of the switchboard with a diagram of the circuits and the switch operating handles incorporated in the diagram as in the Manhattan power house, and having the instruments on a separate set of panels, Mr. Pierce has designed what he calls a "picture panel"; that is, the dummy bus-bars showing the connections and the handles of the switches are placed directly on the panel which bears the measuring instruments. There are, of course, no high-voltage wires around the operating switchboard, as the switches thrown by the attendant operate only the 125-volt direct-current circuit which in turn operates the main oil switches in the 6600-volt circuit. By having the switch handles which indicate by their position whether the circuit is open or closed, directly on the panel bearing the instruments relating to that circuit, there is less chance for error than if the switches are placed on an operating board, and the measuring instruments are placed on a panel, at some distance away.

The design of the dummy circuit indicating benchboard which will be used in the Manhattan elevated power house, New York, marked a distinct advance in the way of clearness of circuit and a decrease in the liability of errors in throwing switches. The switchboard of the Kansas City Electric Light Company may be considered to mark still another important step toward the clearness of circuit connections and the decrease of mistakes in throwing switches. Any one who has had any experience with the switchboards of large stations cannot fail to appreciate the importance of having all connections indicated clearly on the face of the board. Even if the switchboard attendant is familiar with the circuits the danger of throwing the wrong switch is decreased very much by the use of the picture panel. The switchboard will have on the front of the panels a dummy bus-bar running its entire length, and also whatever auxiliary busses are needed. The movement of the switch handles will show directly in diagram on the face of the board whether a machine or feeder is connected to a buss-bar or whether the circuit is open.

The necessity for clearness in the switchboard operation is even greater in a station like that of the Kansas City Electric Light Company, where there are a number of different kinds of service to be supplied, than in a plain railway station. For example, the board at Kansas City is designed to supply sub-stations, feeding a three-wire system, sub-stations driving arc machines and frequency changers, and also to give or take current from the Metropolitan Street Railway power house which is to be constructed. All these require special consideration in the design of the switchboard, and necessarily complicate matters enough, so that, as said before, it is very important that an attendant see plainly on the face of the board, what connections are made.

The oil switches will be placed along one side of the power house, near the generators, and the amount of high-tension station wiring required has been reduced to a minimum. The idea in the design has been to work along the lines of modern methods in steam piping and cut down the length and complication of wiring as much as possible. The use of the auxiliary low-voltage circuits for operating the oil switches make such a directness of circuits possible, since only the low-voltage operating and instrument circuits need to be led to the switchboard.

Mention has been made of the great increase in business which the electric light company has had to meet since the present manage-

ment took charge. The latter part of December, 1899, the maximum load on the Edison three-wire network was 3500 amperes. During the same period in 1900 the load had increased to 6500 amperes, notwithstanding the fact that the theaters had been thrown onto the alternating-current mains. In September, 1901, the maximum load was 8200 amperes on the three-wire network, and there is little doubt but that the load will be 10,000 amperes by the latter part of December. In other words, the load will have been multiplied by three in two years on the Edison system alone, to say nothing of the alternating current and arc distributions. To take care of an increase of this kind has taxed the ingenuity of the engineering staff, and the history of the expedients which have been resorted to in order to carry the load is most interesting. At the start it may be stated that the company had practically no reserve capacity to take care of any increase. How to provide for the load which came on so rapidly in the fall of 1900 was one of the most serious problems. The Helios-Upton storage battery installation, which has been previously described in these columns, was hurriedly installed to help on the peak in the fall of 1900. This, however, was not sufficient for carrying the total load, and a street railway rotary converter was run off the bus-bars at the Armour packing plant, and the output of this was used after proper transformation for the Edison network. In addition to this, the output of the old Edison generators in the downtown station was increased by the liberal use of an air blast.

For the coming winter one of the company's old stations, known as the Santa Fe station, which has been dismantled for some time, will have two 700-hp Corliss engines and two 500-kw three-phase, 25-cycle, 6600-volt alternators belted thereto. Two of the 500-hp boilers already contracted for will be put in this plant temporarily. These two alternators will supply step-down transformers and rotary converters in the two sub-stations, which supply the Edison network, thus helping out the old Edison steam plant. These alternators will ultimately, after the new station is started, be converted into motor-generators or frequency changers. The 25-cycle armature, which will run as a generator the coming winter, will be run as a motor, and in place of the pulley a 60-cycle armature and fields will be placed. These machines will supply the 60-cycle alternating service in outlying districts. In the Edison district there will be two sub-stations. No. 1 will be at the present steam plant, and will have one pair of 200-kw rotary converters and storage batteries to a capacity of 200 kilowatts on each side of the three-wire system. At sub-station No. 2 four 200-kw rotary converters will be put in and possibly some of the direct-current arc machines will be put here and driven electrically by synchronous motors.

Syntonic Wireless Telegraphy.

By A. FREDERICK COLLINS.

THE history of wireless telegraphy since Hertz is fundamentally the evolution of electric wave syntonization. From the evidence at hand it seems clear that the first experimentalist to actually demonstrate the value of telegraphing without wires also recognized that commercially directing a message was quite as important as the bridging of distance.

By directing a message it is not intended to convey the thought that such messages transformed into electric waves, should be literally directed, though this was, curiously enough, the genesis of syntonic wireless telegraphy. That to the beautiful deductions of James Clerk-Maxwell relating to his electro-magnetic theory of light and to the experimental proof so ably given by Heinrich Hertz were the causes, indirectly, of the first error in directing the new space telegrams sounds improbable, yet such, unfortunately, was the case. Maxwell, by a delicate synthesis of Lagrange's co-ordinate system, provided the mathematical evidence showing that the propagation of luminous undulations and the phenomena of electric and magnetic manifestations in vacua may be reduced to stresses and motions of a material medium, ether, and that their only difference is in the length of the waves. On the suggestion of Helmholtz, Hertz took up Maxwell's theory, and, after the manner of the illustrious Faraday, succeeded in producing the desired electric waves, these being, approximately, a meter in length.

By means of his oscillator and resonator, Fig. 1, *a* and *b*, he was enabled, not only to produce them but to analyze their properties and determined that the waves were susceptible to all the tests of wave motion, were capable of being reflected and refracted, and as a final test of wave propagation, that they exhibited the phenomenon of interference. Having all the characteristic of the undulatory motion of light, Hertz concluded with Maxwell, that electric and magnetic waves are manifestations identical with light waves and resultant from the same causes.

Almost a decade before Hertz's classical researches, Professor D. E. Hughes in his experiments with the microphone, discovered the effects of a disruptive discharge on an imperfect electrical contact, but it was not until M. Edouard Branly rediscovered the lost art in 1890 that the coherer invented by him replaced the resonator of Hertz. It was exceedingly sensitive to the waves emitted by a disruptive discharge, and one of its earliest practical applications was to meteorological observations by Popoff and others. Sig. Guglilemo Marconi was working silently with it a few years later as a detector for his wireless telegraph. In this new sphere he makes the first reference appertaining to directing a message or signal projected by the electric waves of a high-tension apparatus, and here is where the relation of light and electricity assisted an error to creep in and rob the new system of a carefully directed message.

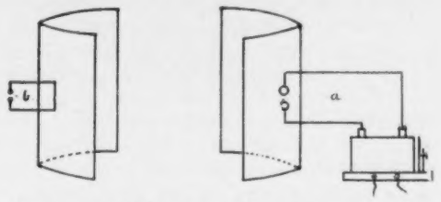


FIG. 1.—HERTZ'S OSCILLATOR AND RESONATOR.

In the first provisional specification of Marconi in England, dated 1896, relating to the transmission of wireless electric signals, he states that "when transmitting through air and it is desired the signal should be sent in one direction, I place the oscillation-producer at the transmitting station in the focus or focal line of a reflector directed toward the receiving station, and I place the circuit-closer (coherer) at the receiving station in a similar reflector directed toward the transmitting station." (Fig. 2.)

MARCONI REFLECTOR SYSTEM.

Marconi's statements were evidently based on an assumption which at that time prevailed, namely, that the emitted waves utilized in wireless transmission of energy as manifested by the coherer action are identical with those waves exhibited by a Riess micrometer spark-gap and therefore are the same as light. In the Hertzian experiment radiators of zinc 40 cm. square were employed on either side of the spark-gap and placed in a horizontal position, whilst in the Marconi scheme the plates are placed vertically. By adjusting the resonator and the oscillator with its radiating plates in the focal line of two large mirrors of planished metal, Hertz found that the spark was accentuated. The same result was likewise obtained when no radiators were employed. In the Marconi apparatus whilst the spark-gap is placed in the focal line of the reflectors, the vertical wire leads from one oscillator to a masthead and there radiates into free space and from the opposite to the ground and there discharges into the earth. From these glaring deficiencies of the reflector as a means of directing wireless messages it will be seen that there is no similarity

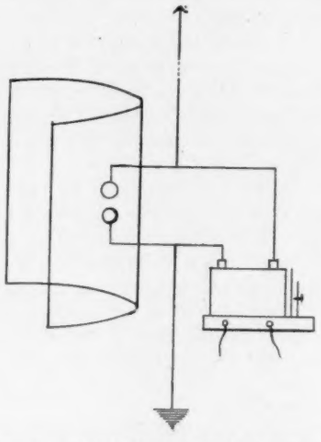


FIG. 2.—MARCONI REFLECTOR SCHEME.

in the combinations of Hertz and Marconi, and that the Hertzian waves and electric radiation used in the wireless telegraph are quite as different as a ray of light when compared to a primary electric current. That the waves available for wireless telegraphy are not radiated directly from the spark is apparent, and it is likewise plain that the effects of the waves are strongest at the terminal plates. The idea of the double reflectors was a curious error and we no longer hear of their use.

LODGE TUNED WIRELESS SYSTEM.

Early in the history of the new space telegraphy Dr. Oliver J. Lodge, of England, made some experimental tests, but purely in the interest of science. The action of the newly discovered waves he applied to telegraphy on a small scale, but the tests were not followed to a conclusion. It was not until Marconi had demonstrated the

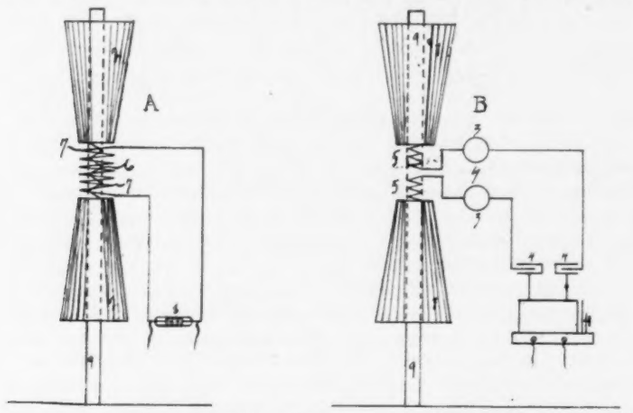


FIG. 3.—LODGE TUNED WIRELESS SYSTEM. A, RECEIVER; B, TRANSMITTER.

practicability of telegraphing without wires that Lodge again took up the subject, and recognizing the prime importance of an absolutely syntonic system for commercial purposes, he developed a tuned apparatus which he patented in Great Britain May 10, 1897, and in the United States Aug. 16, 1898. He states that "the object of my invention is to enable an operator, by what is now known as 'Hertzian-wave telegraphy,' to transmit messages across space to any one or more of a number of different individuals in various localities, each of whom is provided with a suitably arranged receiver, and to effect the ancillary improvements, the nature of which are hereinafter more particularly described and claimed."

The ancillary improvements are a method of "utilizing certain processes and apparatus for the purpose of producing and detecting a sufficiently prolonged series of rapid electric oscillations of a particular frequency or of some multiple or sub-multiple of that frequency." In determining the value of Lodge's method of tuning the analogue of primary resonance in sound waves may be useful in elucidating his theory of electrical resonance and his application of it to the new wireless waves. If two tuning forks identical in pitch, size and form are arranged at a distance apart so as to effect condensation and rarefaction of the waves in absolute conjunction, the sound will be twice as loud as a single tuning fork is capable of producing. In electrical resonance if two condensers or capacity areas have the same period of oscillation or frequency, and if the first one is discharged, similar oscillations will be set up and augmented by the second condenser. Should the charged capacity areas be connected by a conductor of small resistance, there is a sudden surging from the charged to the negative surface in order again to restore the electrostatic equilibrium. Owing to the large self-induction of the coiled wire connecting the condensers, the potential is not instantly nutralized but the surging continues and the recharging and discharging alternately takes place between the two surfaces, each subsequent oscillation diminishing until after several repetitions when the discharge will have found its potential level.

Lodge's capacity areas are virtually condensers, and if the capacity of a condenser in farads is C, the ohmic resistance of the conductor R and the self-induction in heneries L, oscillations will occur if $R > \sqrt{\frac{4L}{C}}$. The frequency of the oscillations is given by the equation $2\pi n = \sqrt{\frac{1}{CL} - \frac{R^2}{4L^2}}$. Thus the oscillations of a quart Leyden jar continue approximately only $\frac{1}{500,000}$ part of a second. But by using a large condensing surface, Lodge obtained oscillations slowed down to 400 to 500 per second. This was determined by viewing the spark through a telescope focussed on a revolving mirror. In his invention Lodge uses as a radiator and resonator a pair of capacity areas or condensers of definite and uniform capacity. These he connects with what he terms a syntonizing self-inductance coil; that is, a single coil of wire or metallic ribbon as above described and shown in Fig. 3 at 5, 5, thus obtaining the necessary inductance with a given amount of current, and the oscillations being prolonged in the capacity areas by the electric surgings, a definite frequency is obtained, theoretically rendering tuning possible.

Lodge was the first to seriously take up the subject of syntonization, employing scientific methods. In Fig. 3, the capacity areas 1, 1, and 2, 2, are triangular sheets of metal which are connected by means of switches to the transmitting and receiving apparatus as desired. Those at Station B are shown in connection with the oscillators 3, 3, forming the spark-gap of a Ruhmkorff coil. Between each capacity area and its oscillator is inserted the self-inductance coil of wire 5, 5, for prolonging the oscillations as before described, and thereby establishing a definite frequency rendering syntony possible, so Lodge states, since exactitude of response depends largely on the emission of a number of successive waves the feeble impulse received being gradually strengthened until it produces a perceptible effect on the principle of sympathetic resonance. The capacity areas are exactly alike at the two communicating stations so as to have an identical frequency. This frequency can be altered by enlarging or reducing the capacity of the Leyden jars in the emitter circuit 4, 4, Fig. 3, and also by varying the inductance coils or both. At the receiving station, A, the capacity areas are connected by a primary inductance coil, 6, and the coherer, 8, in series with the secondary coil, 7, 7. The local battery circuits are not shown, but are connected in the ordinary way. It will be observed that the supports 9, 9, A and B, insulate the capacity areas from the earth and that the system is not grounded at any point. This is undoubtedly the reason for the limited distance over which signals can be obtained, and the construction of the apparatus leads us to suspect that the theory which formed a working basis for this system is that of the Hertzian waves.

At the Royal Society Conversazione held May 11, 1898, in London, a complete set of Lodge's instruments were shown in action operating in a satisfactory way, just as two Leyden jars may be tuned to respond to a similar frequency, but where the earth is to be taken into consideration the hypothesis will not hold good. From recent patent reports it would appear that Dr. Lodge is still experimenting, and with his wide knowledge of electric waves it will not be surprising to hear of his new system being launched forth at any time.

GUARINI REPEATING SYSTEM WITH SLOTTED SHEATHS.

That the electric waves are intercepted, absorbed and conducted by the metals is an irrefutable fact, and to this action we owe some

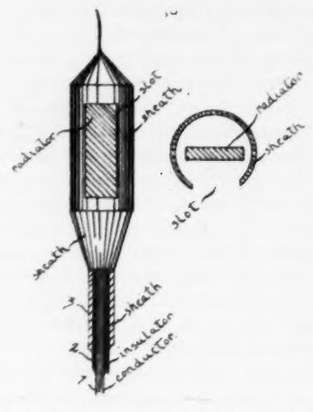


FIG. 4.—GUARINI REPEATING WIRELESS SYSTEM. SLOTTED SHEATH.

clever features in the new space telegraphy. Marconi first applied the metallic casings enclosing the coherer and receiving apparatus this protecting it from the untoward effects that the transmitter in close proximity would produce. The metal box or casing is grounded, thus conducting all extraneous waves to the earth.

M. Emile Guarini, of Brussels, has also made advantageous use of this principle in his system of relaying wireless messages. The aerial wires at Malines were insulated with an outer metallic sheath which diverges at the top into a cylinder of large diameter in which

slots are cut oppositely disposed. With an induction coil giving a 26 cm spark, Guarini was unable to transmit messages between Antwerp and Brussels direct, but with a relay at Malines he could easily send and receive the signals. To send and receive at Malines simultaneously by the wireless method is not a problem unattended by difficulties, for the waves incoming and those outgoing will conflict and the message thus be lost unless special means are adopted to remedy this defect. This Guarini did by first insulating the vertical wires and then encasing them in metallic sheaths (Fig. 4), which were grounded, and the extraneous waves made to pass into the earth whilst the desired waves were received through the slots and likewise transmitted through the opposite slot. There is, no doubt, a tremendous loss of initial e. m. f., yet this loss of energy is not equal to that caused by increasing the distance to twice the length, as Guarini has shown. The combination he employed and the operation is as follows:

The relaying device consists of a coherer and its incident paraphernalia coupled with an induction coil and oscillators. From one of the conductor plugs of the coherer a strip of copper, 1, is enclosed by an insulating medium, 2, and this in turn by the sheath, 3, which leads to the mast. The copper sheath with the slot and interior strip is shown in Fig. 4. From the opposite conductor plug a wire leads to the copper plate buried in the earth. This is the extraneous or electric wave system, the connection of the local circuits being similar to those of other forms utilizing the coherer and spark-gap. The action of the wave system when the spark passes across the gap at Brussels is to project the energized waves toward Malines, the slot in the sheathing facing in that direction. At Malines the slot facing Brussels receives them and they are conducted to the apparatus proper where they are re-energized and via the vertical wire and its attending slot, transmission is again effected toward Antwerp.

Guarini advances the peculiar theory that the radiators and resonators must be within sight of each other or there can be no successful transmission. This seems to follow the Hertzian wave thought, and the belief that these electric waves are propagated in straight lines. The Guarini system of excluding all the undesirable waves bears no relation to true syntonization, but nevertheless accomplishes it in a crude and limited way.

TOMASSI-JEGON DIFFERENTIAL WIRE SYSTEM.

Another measure applied to determine individual wireless messages where three stations are employed is that of the Tomassi-Jegon system. With the exception of the slotted-sheath scheme of Guarini this is the simplest in theory and the least effective in practice, although it has accomplished all that has been claimed for it. In the strict sense of the word it is not a tuned or syntonized system, but like the one before described, it separates the messages in a limited way. In its simplest and most easily understood form a Jegon equipment representing a three-station system may be reduced to a single transmitter and two receivers at a distance apart, as diagramatically represented at Fig. 5, *A, B, C*. At the transmitting station, *A*, two vertical wires are suspended from a mast. These radiating wires are of different lengths, one being one-fourth longer than the other. At the receiving station, *B*, 5 km. distant, the vertical receiving antenna is equal in length to the shorter one at *A*, whilst at station *C* the receiving wire is the equal of the longest radiating wire at *A*. It will be seen that four wires are employed, two at the transmitting station and one each at the receiving stations. Now, by adjusting the individual coherers at *B* and *C*, and the galvanometers employed as the translators are not actuated except when the shortest wire at *A* is sending to *B*, or the longest one at *A* to *C*, except, as Jegon points out, where a definite value of the distance produces absolute neutralization of both receivers.

SLABY-D'ARCO MULTIPLE WIRELESS SYSTEM.

We now leave the practicable for the more or less practical results that have been obtained in tuned or multiple wireless telegraphy. As is very often the case in discovery and invention, those who have been largely responsible for the new art of syntonization have worked out independently, and it may be said often simultaneously, factors that are closely analogous. The first patent granted, excepting the one Lodge described, relating to a tuned system is that devised by Mr. W. G. Brown, of England, and is dated July 13, 1899. In the provisional specification of his English patent he claims the novelty of two vertical wires or conductors of unequal length joined to each side of the spark-gap. Now, in this dual wire system which both Brown and Jegon have employed to some little advantage, although each in a different way, lies the keynote of the work of Slaby and Marconi.

Since Dr. A. Slaby, of Charlottenburg, Germany, was the first to make public the methods employed by him and his collaborator, Count D'Arco, in their tuned or multiple wireless telegraphy, as exhibited before the German Emperor, when two messages were received simultaneously from different stations, their system will be described first. The result of the Slaby-D'Arco experiments has led them to a number of original conclusions, one of them bearing on syntonization being to refute the law giving the distance over which the waves would be transmitted as proportional to the square of the length of the sending and receiving wires; though Dr. Slaby does assume that the lengh of the wire terminating in the air is of great importance since it should be one-quarter of the received wave length or an uneven multiple of the wave length. To demonstrate this Slaby gives an interesting mechanical analogue with a vibrating steel wire. In Fig. 6, *A*, it will be seen that in a flexible steel bar where the wave is produced by mechanical vibration or by electric oscillation the greatest amplitude is at *a*. In Fig. 6, *B* illustrates the vibration of a steel wire bent to form a right angle having legs of equal length, and if the angles be firmly clamped to a fixed object and if one leg be vibrated, stationary waves will be set up in the steel wire, *b*, as shown, and the vibrations transmitted to the leg *c*, which will respond in syntony to *a; d, d*, the fixed points are the nodes and the wave crest and the wave valleys are represented by the dotted lines.

Slaby assumes that if the legs *a* and *c* are the vertical wires of the wireless telegraph sending and receiving stations, respectively, the connecting wire *b* is replaced by the ether. It is therefore evident that the coherer should be attached to the highest point of the receiving wire, where the amplitude of vibration is the greatest, and the oscillations the strongest when corresponding to the wave frequency. In the original or non-syntonized wireless telegraph one conductor plug of the coherer is connected directly to the terminal of the aerial wire nearest the earth and the second with the earth direct (Fig. 7). In the Slaby-D'Arco system this arrangement has been superceded by grounding the receiving wire or antenna direct, which forms a node for the waves. At the nodal point or earth end of the wire a second or auxiliary wire equal in length to the receiving wire is attached, and a wave crest will be formed having the same amplitude as that of the end of the vertical wire in the air (Fig.

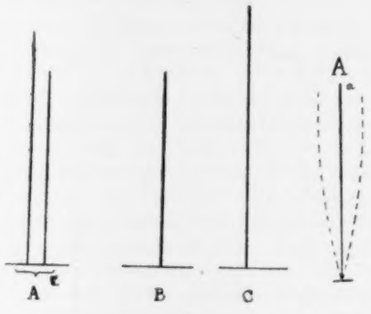


FIG. 5.—TOMASSI JEGON DIFFERENTIAL WIRE SYSTEM.

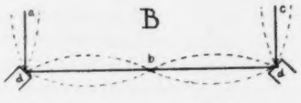


FIG. 6.—MECHANICAL ANALOGUE OF ELECTRIC WAVES.

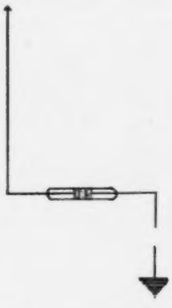


FIG. 7.—ORIGINAL WIRELESS TELEGRAPH.

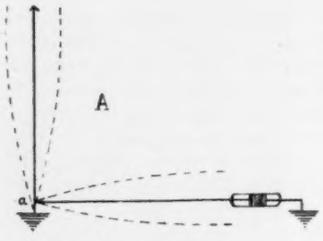


FIG. 8.—AMPLITUDE OF ELECTRIC WAVES.

8). To economize space, Slaby forms a coil of the duplicate wire, as shown at *B*, Fig. 9. It is this portion of his system that he terms his multiplicator, and by this means he points out that lightning rods may be made to serve the purposes of the antenna instead of a specially arranged one.

According to the principle here involved the waves received by the vertical antenna that are not of the predetermined length will pass into the ground, since the nodal point of the predetermined length of wave is at a point just above the earth, *a*, *a* (Figs. 8 and 9). Slaby's theory that the earth acts merely as a capacity and not as a conductor between the two stations is based on the resultant action of his apparatus constructed according to this view. To receive signals from any desired station separate coils of wires representing different wave lengths may be switched in, forming a connection with a single aerial wire.

Slaby's new transmitter is not subject to the defects of his previous one. It is shown in Fig. 9, and his former one in Fig. 10. It will be seen by referring to *B* (Fig. 9) that it is similar to the receiver in so far as the vertical wire is concerned which is grounded. This antenna emits waves of great amplitude, but must be tuned to the wave length produced by the wave producing apparatus and its system, which includes the inductance 4 and the capacity 5. The induction coil, 1, serves to regulate the fundamental harmonics of the sender, which produces waves of any desired length; 2 is the exciting spark-gap, 3, 3 the horizontal conductor with the tuned self-inductance coil and the capacity. In order to further regulate the vibrations of the exciter the coil 1 is brought into action. Slaby lays great stress on the necessity of tuning the exciter, 3, 7, with the sending or emitting system, 6, 8. He points out that by increasing the capacity of the exciter it is not possible to obtain any stronger effects in radiation. The capacity, 5, can be replaced by a conductor and coil of wire, but the method shown is more compact. The system shown permits of tuning to be effected between the transmitter and receiver, which is accurate to within 3 per cent, and this is very exact. Again, the air wire, 6, is connected directly with the earth, and as the tension is low there can be no fatal results from physical contact with it, while its emitting efficiency is great. To obtain a radiation equal to other systems, Slaby claims that only half the amount of primary current is needed, and this is of considerable importance in places where the storage or a primary battery must be employed.

In Fig. 10 is shown the original form of the Slaby-D'Arco transmitter, wherein a loop or circuit is formed by the dual vertical wires connected at the top by the coil and at the base by the earth. Lodge has demonstrated that in such a closed system the oscillations are very persistant, but the vertical wire acts feebly in emitting the waves. The new Slaby transmitter eliminates the latter feature without greatly damping down the oscillations.

MARCONI SYNTONIC WIRELESS SYSTEM.

In his system of syntonic wireless telegraphy Marconi has also obviated the untoward effects of the closed circuit system, but in quite a different manner from that of Slaby. In theory and in practice the

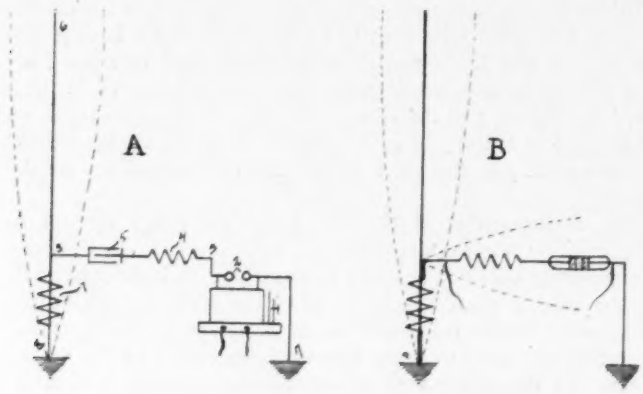


FIG. 9.—SLABY D'ARCO MULTIPLE WIRELESS SYSTEM.

two systems are widely divergent. Marconi has worked upon similar lines to those laid down by Lodge in the previously described apparatus, except that he has found the earth wire absolutely indispensable. He has striven to produce an emitter that will amplify the oscillations, and though each oscillation may be in itself feeble, and the syntonized receiver may not respond to the first few oscillations it will be receptive to a succession of the impulses, so that after several of the oscillations have acted on the coherer its resistance breaks down and the receiver is made operative.

To produce these persistent oscillations Marconi employs, instead of the usual form of high vertical antenna, an inner copper cylinder, *A* (Fig. 11) connected with the earth and one terminal of the spark-gap 2. The outer cylinder, 3, is connected to the opposite terminal of the spark-gap, and though the cylinders represent so great a capacity, the oscillations are made very persistent, for the inner and outer concentric cylinders with its dielectric of air acts as a Leyden jar, and the difference of potential is equalized by the impulse swinging to and fro many times. The Marconi receiver is shown at *B* (Fig. 11). To tune or syntonize the receiver to the transmitter it is necessary that the coefficients of capacity and inductance in the circuits be identical. Marconi says if we start with a very small capacity which we gradually increase, a value of the capacity will be reached which will cause signals to be recorded on the receiver. Supposing the receiving station to be within the sphere of action of the transmitter, then the signals will be the strongest when the capacity of the condenser is of a certain value. If we still increase the capacity, the signals will gradually die away, while if we go on increasing the capacity and at the same time add inductance to the aerial wire to keep it in tune with the condenser circuit, we are still radiating waves, but these do not affect the receiver. If, however, at the receiving station we add inductance and capacity to the wire, 1, and also to the terminals, we find ourselves able to receive messages from the transmitter, although we are utilizing waves of a different frequency.

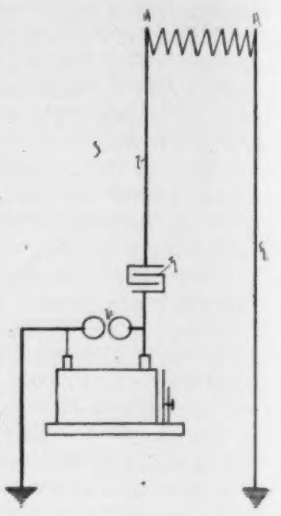


FIG. 10. — SLABY D'ARCO MULTIPLE WIRELESS SYSTEM TRANSMITTER.

This practically represents the state of the art at the present time. There are other investigators who have done excellent work, but the principles here described are involved to a greater or lesser extent. The apparent success of the selective systems should not be taken as a standard for absolute syntonization, for contrary to the opinion of a contemporary worker in this special field, the writer does not believe that the laws governing wireless transmission of energy as characterized by the disruptive discharge are fully known. The results thus far at least hardly justify our claiming a full and complete knowledge of them. That the production of given wave lengths may be accurately determined and the effects of inductance and capacity on the oscillatory waves are commonly known, is also true; but the mode of propagation of these waves after their emission from the radiators through space and the role the earth plays, what absolute knowledge have we to boast of here? It is yet an open question whether the electric waves are projected in straight lines, or whether they follow the curvature of the earth. When wireless telegraphy first made its debut as a commercial commodity it was assumed that the waves obeyed the same laws that govern those of

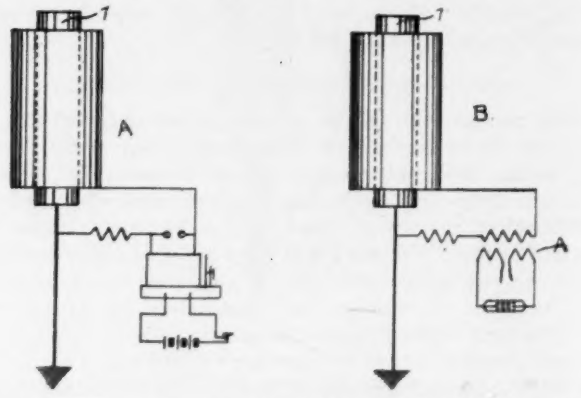


FIG. 11.—A, MARCONI SYNTONIC WIRELESS TRANSMITTER; B, MARCONI SYNTONIC WIRELESS RECEIVER.

light. In this case intervening hills and the curvature of the earth would intercept them, but this does not hold good, since messages have been transmitted 150 miles with vertical wires 190 ft. high.

In the Lodge system mention is made concerning the earth as a capacity. In the Slaby-D'Arco it is used as a means for receiving extraneous waves. In Marconi's recent paper he does not state specifically the reason for grounding the inner cylinder.

In a recent article over the name of M. Guarini a case is cited wherein the Marconi syntonic system failed in its action during some tests near Nice, when a dispatch transmitted from Biot to Calvie was intercepted at Ville Franche in its entirey and with perfect distinctness. The Belgium inventor states that he also tried the Marconi method of syntonization, but with complete disaccord, and that though the distance was more than 2½ km., exchange of signals could be maintained almost as well as with complete tuning. Sig. Marconi on the other hand, states that he installed the apparatus described by Dr. Slaby at Minton, Isle of Wight, and at Poole, using wires 35 meters high, but with the receiving wire earthed at the nodal point of the loop in accordance with the Slaby specifications, he could receive nothing, although he tried various frequencies.

This is the other, the seamy side of wireless tuning. It would appear that the laws already worked out were either incorrect or misunderstood. That any of these systems are commercially accurate is doubtful, yet the failure of one inventor to produce another's system and obtain satisfactory results is insufficient evidence that such system is without merit, for each worker may keep secret some minute but mighty factor that is safer in his own keeping than it would be if publicly labeled with the patent protection of a government.

It is not at all strange that with the meagre information regarding the details of the apparatus that men of different temperaments and especially of different countries should fail utterly to reproduce an identical system, which, when all is said, the original inventor does not himself grasp perfectly. But it is good to know that all these geniuses have done as much, and some of them more, than is usually the lot of this class of workers to do. And there is yet enough to do for syntonic wireless telegraphy is a new art looming up a gigantic factor on the horizon of the twentieth century. The work that has been done need deter no one who cares to essay the porduction of a syntonic system, but let him be forewarned that the difficulties which beset the path of those who would devise a commercial system are manifold.

But the gun has been fired, the smoke is clearing away, and a clearer and better view of what has been and is yet to be accomplished is gradually coming into the range of our mental perception.

The Zossen Polyphase Railway Installation for Experimental Trials with Speeds Up to 125 Miles an Hour.—VII.

By Walter Reichel.
(*Chief Engineer Siemens & Halske Company.*)

(*Concluded.*)

TESTS AND FINAL RESULTS.

THE resistances were tested first without cooling, and afterwards with cooling by an air current having a velocity of three to four meters per second. The tests were made with different intensities of currents and continued in each case until the normal temperature was arrived at, or in the case of high currents until the laminations of which the resistances were composed showed a dark red heat. The results of the tests are shown in Fig. 41, the temperatures referring to the centegrade scale. Without cooling and without giving forth any visible rays the resistances carried 300 amperes, which is more than that to which they will be submitted when working (210 amperes). At starting, however, 400 amperes will be taken by the resistances for 2½ minutes, and the test showed that without cooling the resistance would withstand this current for 4 minutes before becoming red hot. Owing, however, to the air passages in the resistances and the air that will be admitted to them, they will in practical operation be submitted to a strong cooling effect, so that the tests demonstrated their adequacy.

As to the rheostats, tests were made by cutting out energy at the rate of about 20 horse-power per step in order to observe if any injurious sparking occurred at the contacts. After a series of 150 of these operations with current at 500 amperes, 50 cycles and 40 volts, the rounded edges of the contacts were slightly burned, but this did not

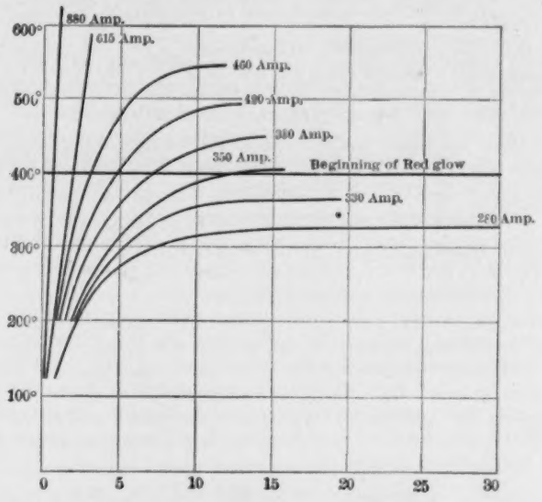


FIG. 41.—RHEOSTAT TEMPERATURE CURVES.

interfere with the working of the contact arm, and the contact surfaces remained in perfect condition.

The low-tension switches were tested by connection with transformers, the voltage being gradually increased up to 6000. Both the

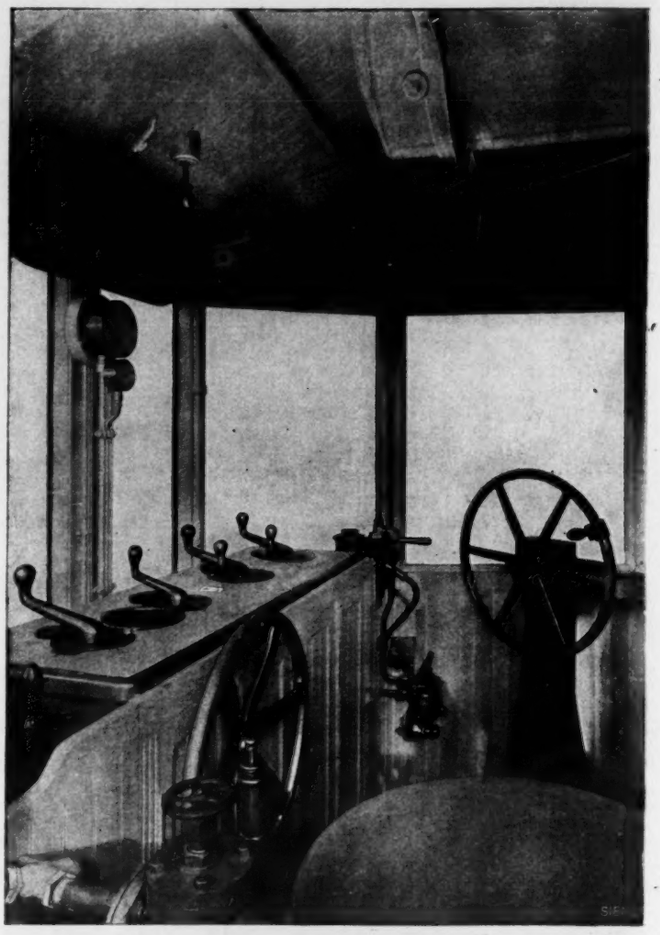


FIG. 42.—CONTROLLING APPARATUS.

high and low-tension switches were also tested with the motor at normal voltage until the fusing current value was reached. At that point the switches worked properly and the fuses blew accurately. The

switches were operated, as they will be normally, by compressed air. Thus not only their electrical operation was tested, but also their mechanical manipulation as well as the packing and piston of the air cylinders. In addition, the latter were tested up to a pressure of 20 atmospheres.

Both the large and small transformers were tested for insulation by being submitted to 20,000 volts for one hour.

HIGH-TENSION SAFETY DEVICES AND INSULATORS.

The rubber and other insulation was first tested by alternating current up to 30,000 volts at 60 cycles in the form of small specimen bars. Then grooved sample bars 2½ inches in diameter and 16 inches in length were tested while subjected to a spray of water, and withstood 12,000 volts to earth, and consequently 24,000 volts with respect to a pair. The tests show that with a grooved surface an insulating length to earth of 16 inches was sufficient for 1500 volts.

The trolley wire insulators were tested under a drizzling rain, and the cup insulators proved to be sufficiently safe for 20,000 volts, and the trolley supporting insulators, three of which were connected to each other in series, were subjected to 5000 volts.

In testing the high-tension switches a device was constructed involving the principles of the Siemens horn lightning arrester. It was found, however, that in a draught of air a short-circuit may arise from the arc blowing out. Another arrangement was, therefore, employed and satisfactory results were arrived at.

A bow sliding contact device installed on a truck which was hauled over the Gross-Lischterfelde road by the three-phase locomotive used on the trials over that road, which latter was supplied with its energy by the current collector under test. The contact was sparkless, and the adjusting mechanism worked well.

Special care was taken in testing the compressed air plant. The cylinders operating the switches and rheostats, as well as the rubber connecting hose, were tested as to their packing with air under pressure of 20 atmospheres, and the valves with water under 12 atmospheres. The car air valves were tested at 8 atmospheres. The tests showed that the efficiency of the air compressed apparatus was excellent.

After installing the whole electric equipment on the car, the circuits and apparatus were put under a tension of 15,000 volts.

When the installation was entirely completed on Sept. 16 the entire weight of the car completely equipped was found to be 89,000 kilograms (196,000 lbs.). This corresponds almost exactly to the calculated weight. Tests have shown that all of the hand manipulations can be very evenly performed as was designed. The arrangement enables the engineer to instantly make all manipulations without moving from a given place. The starting is very simple. The two handles to the right in Fig. 42 are not touched while the car is in motion. In starting the second lever to the left, or motor lever, is thrown in and the hand wheel turned step by step. In cutting out, the motor lever is reversed and the throwing out of resistance occurs simultaneously. The furthest lever to the left is only used for starting the air pump. The motorman cannot come into contact with any insulated wires, much less with any bare terminals.

Fig. 43 shows the car about to start on its first trip.

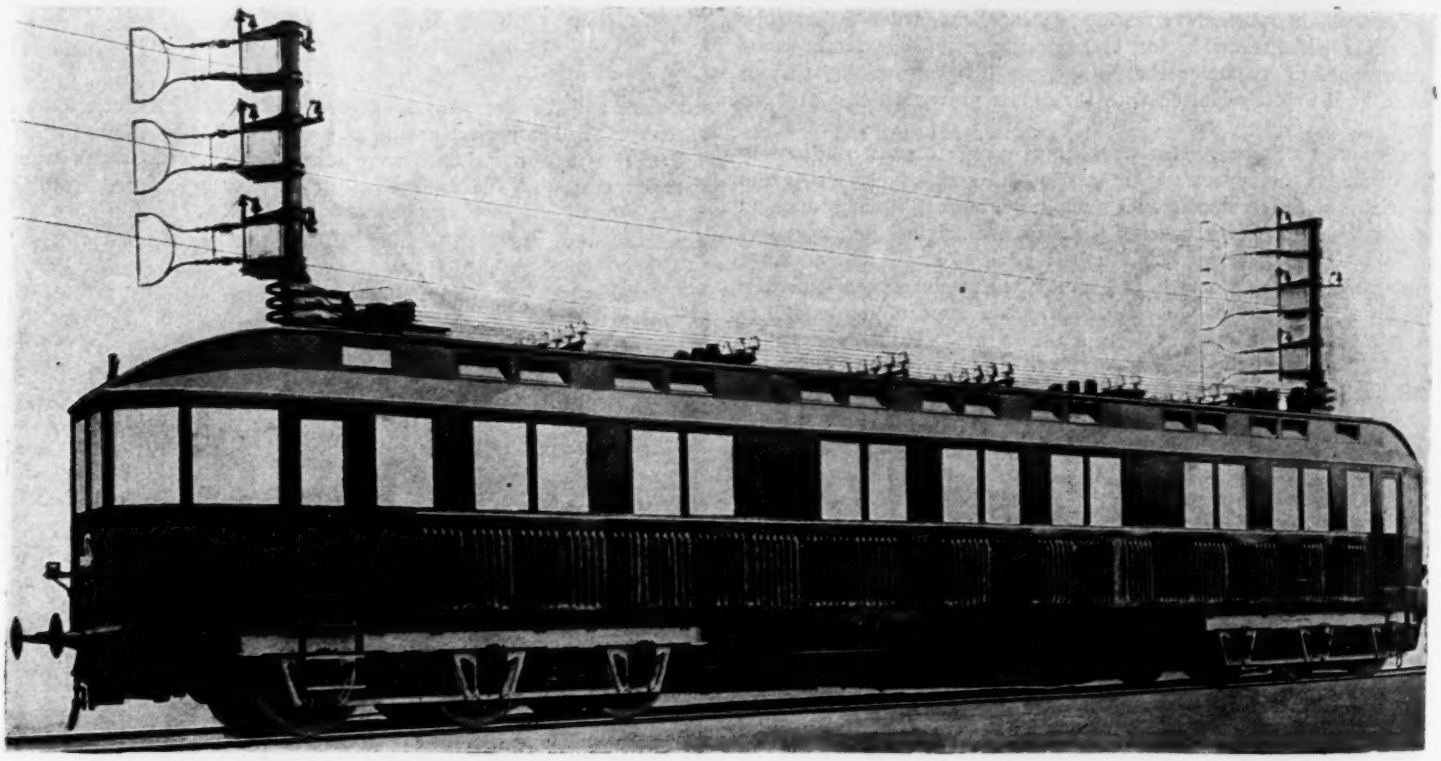


FIG. 43.—CAR READY FOR ITS FIRST TRIP.

The Nobel Prizes

Prof. Chas. E. Munroe, Professor of Chemistry and Dean of the School of Graduate Studies of Columbian University, of Washington, D. C., has been designated as the representatives in the United States of the Royal Swedish Academy of Sciences, which will confer the Nobel prize for the most important invention in chemistry.

Alfred Nobel, who died at San Remo Dec, 10, 1896, provided in his will that the interest on a capitl which he bequeathed should be annually divided into five equal parts, to be awarded as prizes to those persons who should have contributed most materially to benefit mankind during the year immediately preceding, as follows: One part to be given to the person having respectively made the most important discovery or invention in the science of physics, in the science of chemistry, in the science of physiology or in medicine, for the most distinguished work of an idealistic tendency in literature, and to the person who shall have most or best promoted the fraternity of nations and the abolishment or diminution or standing armies and the formation and increase of peace congresses.

The contest of the will by the heirs-at-law is now over and the conditions under which the awarding of the prizes are to be made have been formulated and the first awards are to be made in 1902. At the time of Nobel's death his estate was estimated to have a value of from 30,000,000 to 35,000,000 kroner, which, if invested at three per cent, would yield an annual income of from $240,000 to $270,000. Each fifth would thus amount to $48,000 to $55,000. Since then 1,500,000 kroner have, by agreement with the heirs-at-law, been set aside for the foundation of Nobel institutes in Sweden, but at the same time the interest for the intervening years since Nobel's death has been accruing, so that the exact value of each annual prize is not now known.

Under the conditions it is essential that every candidate for a prize under the terms of the will be proposed as such in writing by some duly qualified person. A direct application for a prize will not be taken into consideration.

The right to hand in the name of a candidate for a prize belongs to (1) Home and foreign members of the Royal Academy of Science in Stockholm. (2) Members of the Nobel Committee of the Physical and Chemical Sections. (3) Scientists who have received a Nobel prize from the Academy of Science. (4) Professors, whether in ordinary or associate, of the Physical and Chemical Sciences at the universities of Upsala, Lund, Christiania, Copenhagen and Helsingfors, at the Caroline Medico-Chirurgical Institute and the Royal Technical College in Stockholm and also teachers of the same subjects who are on the permanent staff of the Stockholm University College. (5) Holders of similar chairs at other universities or university colleges, to the number of at least six, to be selected by the Academy of Science in the way most appropriate for the just representation of the various countries and their respective seats of learning. (6) Other scientists whom the Academy of Science may see fit to select.

Acting under Section 5 of the conditions given above, the Royal Swedish Academy of Science has conferred an honor on the Columbian University, of Washington, D. C., by designating Prof. C. E. Munroe as one of the six representatives in chemistry in foreign countries.

The Royal Swedish Academy of Sciences confers the prizes in chemistry and physics only. The prizes for peace are conferred by the Norwegian Parliament and the prizes in literature and medicine by their respective academies. The foreign representatives in these departments and in that of physics are not yet announced.

The Electrical Protection of Vaults.

The remarkable robbery which recently took place in the Chicago post office, where the burglars got away with many thousands of dollars' worth of stamps after a comparatively easy job in drilling through the vault walls from an adjoining underground passage way, and in which the burglars were aided by miniature incandescent lamps operated by portable batteries, has called forth some comment on the new use of electricity in burglary. Such comment is, of course, idle and valueless. The point that should occur to the thoughtful electrical engineer in this connection is the possibility of preventing such losses by the use of modern burglar alarm systems. It is a fact not sufficiently appreciated even by electrical men who should be posted on such matters, that it is possible by electrical means to throw around a vault or safe a protection from burglary more absolute than can be obtained in any other way. Although the perfection of vault steel has reached a point where the burglar must be skilled indeed if he penetrates it, still there is always the possibility that it can be done. But a vault, however flimsy, if protected by an electrical lining, connected to sufficiently delicate circuits, the disturbance of which in any manner is absolutely certain to give an alarm, makes it impossible for a burglar to enter a vault without the fact being known either at a central office or by the general public in the vicinity. Of course, a certain amount of mechanical protection is necessary even with an electrical alarm system in order to hinder a raid. It is, however, safe to say that few burglars care to attack a safe with the positive assurance that an alarm will be sent in the instant they penetrate the electrical lining.

This much should be said in justice to the inherent possibilities of the arc of electrical vault-protection, as indicated by what has been actually accomplished. It is a matter to be regretted that the commercial development of burglar alarm systems of the highest class has not always been in hands possessed of the best technical or business foresight. For example, one beautifully worked out protective system has apparently been the tool of stock jobbers and speculators rather than the means of the large legitimate commercial development to which its inherent merit entitled it. This, too, coupled with attempts to alarm the banking fraternity by exaggerating the possibilities of the electric arc as a burglar's tool, and a lack of thoroughness and technical business ability in carrying out and maintaining the work installed and in keeping abreast of the times in improvements, has also marked the burglar alarm industry. Some of the systems, as said before, are of great inherent excellence, but faulty workmanship and maintenance have caused them to come into disrepute. Other older systems have not been improved as time went on, as they might have been, with the result that their imperfections have been exposed greatly to their detriment. It is not, however, likely that so legitimate a branch of electrical industry will always suffer from commercial mismanagement, as it has in the past. The very matter of economy in first cost alone is conducive to the installation of modern vault protecting apparatus because the electrical protection is cheaper to install and maintain than many of the elaborate mechanical expedients that have been proposed and used.

There is probably a greater need for the fool killer among inventors of devices for protecting against burglaries, than in any other branch of the electrical business, but that does not in any way discredit the use of the legitimate and thoroughly thought-out systems.

Work of the U. S. Signal Corps.

General Greely, chief signal officer, has just issued his annual report at Washington. In the course of it he says: The operations of the signal corps have been coexistent with the operations of the army of the United States, not theoretically, but on broad lines and activities which have comprised practically the entire area, not only of the United States proper, but also of Alaska, Cuba, Porto Rico, the Philippines and a portion of China.

The muster-out of the last volunteer soldier would seem to mean a reduction of work, but in an electrical age the demand of our active and progressive generals has developed in the American army the application of electricity to war on a scale unprecedented in military history. Incessant demands were made by military commanders for inter-communication with their detached organizations by telegraph and by telephone, in addition to the former methods of visual signaling.

General Greely says the corps should be increased to meet present demands. There have been constructed 336 miles of telgraph line in Alaska, and arrangements have been made with the Canadian Government to use its line to Alaska. The signal corps operates 3418 miles of telegraph in Cuba, an increase of 162 miles during the year.

The operations of the corps in the Philippines have been very extensive, there being 4801 miles of telegraph line, an increase of 2054 during the year. The military cable lines in the Philippines connect Manila with Mindoro, Marinduque, Masbate, Samar, Leyte, Cebu, Negros, Mindanao, Jolo and Siasi.

With regard to the work in the Philippines, General Greely reports that it has been done under very great obstacles, and says if the officers and men of the Signal Corps had struggled only against the natural disadvantages they were under, their work in the Philippines would have commanded commendation; but to this must be added the extreme difficulties arising from the practically constant efforts of the insurgents to destroy indispensable means of intercommunication. In the region southeast of Laguna de Bay, Santa Cruz to Antimonan, and thence to the head of the Gulf of Ragay, the insurgent troops had caused no end of trouble and annoyance, not only by the cutting of the wire, but by the removal or destruction of considerable stretches of line. The commanding officer of Santa Cruz informed me that experience had caused him to furnish every repair party with at least a mile of wire, as nearly that amount was taken away at each break. Destruction of sections of two, three or even five miles of line were not unusual, but the climax was reached in the total destruction of 38 miles of line, every insulator being broken, every bracket destroyed or removed, every pole cut down, and the entire wire carried away.

General Greely recommended an international cable conference to prepare regulations for cables. Concerning experimental work he says: In wireless telegraphy the Signal Corps has perfected its own system, which was the first one ever successfully operated in the United States, on September 30, 1899, bewteen Fire Island and Fire Island Lightship, a distance of 10 miles. There are now in successful operation two stations in San Francisco harbor, one at Fort Mason, and another at Alcatraz Island. Arrangements have been made for the establishment of stations in the Philippines at suitable points. The chief signal officer adheres to the opinion that this system has its limitation, which are not entirely dependent on distance.

In regard to a Pacific cable the report says: It is only a matter of time when Luzon shall be connected with Japan and Tonquin and the Chinese Empire. The Philippine Islands are now only accessible telegraphically over a short cable of about 600 miles of the Eastern Extension Company between Manila and Hong Kong. The experiences of the War Department in connection with the relief

of the legation at Pekin show clearly the tremendous disadvantage under which the United States would labor without its own cable facilities in case of an extended war in the East. An American trans-Pacific cable is a military and commercial necessity, if American interests are to be safeguarded in Asiatic regions. Such a cable, while of great value militarily, will especially foster industrial interests, and facilitate commercial operations. As it is officially known that an American cable can only enter Japan from the east, and not from Russia, China or the Philippines, the only possible route is that already recommended to Congress by the President, via Hawaii and Guam.

The Activity of American Manufacturers.

It would appear that American manufacturers are quite as busy in 1901 as they were in 1900, from an examination of the figures of the Treasury Bureau of Statistics. The total imports of manufacturers' materials in the nine months ending with September, 1901, were greater in value than those of the corresponding months of last year, although an analysis of the imports, article by article, shows that in many cases the prices per unit of quantity have decreased. This decrease in price is so strongly marked that in many cases while the figures of value show a decrease in the nine months of 1901 as compared with those of 1900, the figures of quantity for the same period show an increase. For instance, imports of india rubber, when measured by value, show a slight reduction in 1901 as compared with 1900, while the quantity imported in 1901 shows an increase of more than 5,000,000 pounds as compared with the same months of 1900. Pig tin, used in manufacturing tin-plate, shows in value a slight reduction in the imports of 1901 as compared with last year, but in quantity there is an increase of over 2,000,000 pounds. Imports of unmanufactured fibers show a decrease of more than $2,000,000 in value as compared with those of 1900, yet the quantity shows a material increase. Taking the grand total of value of imports of raw materials for use in manufacturing, the imports in the nine months of 1901, compared with those of 1900, were: For 1901, $221,469,984; for 1900, $217,619,372; while in the month of September alone the figures of the month in 1901 are $22,725,325, against $18,505,980 in September, 1900, a marked increase. They formed in September, 1901, 34 per cent of the total imports, against 31 per cent of the total imports in September, 1900.

The Storage Battery in Telephone Work.

Mr. J. G. Wray, of the Chicago Telephone Company, gave a very profitable talk before the Chicago Electrical Association on the above subject the evening of Nov. 1. In Mr. Wray's remarks he considered batteries more from the standpoint of a telephone man than a storage battery expert. As an introduction he mentioned four points which rendered the storage battery especially suitable for telephone work as compared with primary batteries. The first of these was low internal resistance. This low internal resistance is a strong point in its favor, especially where a number of transmitters are supplied from the same battery. The greater the internal resistance of a battery in such cases the more liability there is to cross talk. A battery of zero internal resistance would, of course, be the best. A storage battery comes nearest to this ideal theoretical condition. The storage battery is cleaner and more desirable to have around a telephone exchange than a primary battery even like the Edison-Lalande. Its uniformity of voltage with various loads is another point in the storage battery's favor as compared with the primary battery, as the variation of voltage of the primary battery interferes much with the requirements of a telephone exchange. The fourth advantage of the storage battery is that it does not need to be renewed by the addition of chemicals as does a primary battery, but is renewed in place without any mechanical disturbance.

Eight or nine years ago the storage battery was practically unknown in telephone work. Signaling was done by magneto generators, and what batteries were needed were all of the primary type, individual batteries being placed at the subscribers' instruments and a set of primary batteries being used at the central office for the operators' transmitters. A little later the practice of signaling on trunk circuits with primary batteries was begun, using potassium bichromate, gravity, or Edison-Lalande cells. Storage batteries followed primary batteries for use in this work. The custom at first was to charge a set, put it in place and when it was discharged to replace it with a freshly charged set. The introduction of lamp signaling a little later called for the use of more batteries. At first it was customary to have a couple of storage calls at each subscriber's instruments. These were charged at the central office, taken out to the subscirbers' instruments and replaced with newly charged cells as often as necessary. It was soon found practical, however, to charge the batteries over the subscribers' line from the central office. The batteries in this work gave very good results. Following the use of the lamp signaling or express system came the common battery or central energy system, in which all the electrical energy needed for the exchange was supplied from a 24-volt battery at the central station. The battery capacity at the telephone exchange of to-day is 10 to 20 times what it would have been in an exchange of the same size five years ago. The evolution of the telephonic art brought out from time to time the use of batteries of a great many different voltages, so that an exchange would have a battery for signaling, a battery for talking, a battery for lamp circuits, and so on. The central energy system has done away with the complication of many different voltages of battery, and everything is supplied from a standard 24-volt battery circuit.

A standard practice of the telephone interest with which Mr. Wray is connected is to have a battery of sufficient capacity to carry the entire load of the telephone exchange for two days if the source of power is interrupted. In actual practice batteries will be found in use in some places which will carry the exchange for seven days. The batteries in the present central energy systems are charged through a motor-generator supplied from the Edison three-wire system in cities where that service can be obtained. The standard practice is to install a gas engine and generator for use in case the Edison service should fail. The exchange, therefore, has not only the reserve capacity of the battery for emergencies, but the gas engine. The first batteries used by the Chicago Telephone Company were the old American type, which consisted of a plate or a sheet folded back and forth upon itself. The Pumpelly pasted type of cell was next used, but this was later replaced by the Pumpelly "formed" or Planté type, which latter was found to be well suited to telephone use. Many of these batteries are in use by the Chicago Telephone Company to this date. The insulation between the plates in the earlier batteries took on various forms of asbestos and rubber mats, but later standard practice in which the batteries were made heavier and less liable to buckle has involved the use of glass tubes to separate the plates and plenty of free space between the plates. The use of oil to prevent spray has almost been abadoned. The deterioration of batteries in telephone work Mr. Wray considered to be more than in any other class of service, and he was at a loss to account for this, as conditions were in some respects favorable to them.

When the chloride type of batteries first came in there was much trouble from the dropping off of the lugs. A growth would also form on the positive plate, and the buttons of active material in these plates would fall out. This dropping of the lugs was due to corrosion at the top of the solution. There was so much trouble of various kinds with the positive plates of early chloride cells that it was claimed by some that rival battery makers had in some way doctored the cells. That theory was exploded, however, by an experiment in which some plates fresh from the factory were boiled for some time in distilled water and the water so obtained evaporated. The result was a considerable amount of chloride of zinc, which demonstrated that the chloride had not all been extracted in the manufacture of the positive plates. This trouble has been quite overcome by the use of the present Manchester type of plate as positive in the chloride battery.

In conclusion Mr. Wray propounded some interesting questions as to why depreciation is so rapid in telephone service, and raised the question as to whether the battery would give its best service when worked fully through its cycle of charge and discharge or only part through this cycle. In telephone work, of course, the whole cycle of charge and discharge rarely occurs. Professor Woodworth, in discussion, in answer to the question as to why batteries depreciate so rapidly in telephone work, asked another question which was: "Why do storage batteries depreciate so much more rapidly in other work than in telephone work?" He had had considerable experience with storage batteries, having been connected with the early experiments of Mr. Chas. F. Brush, and he is now occasionally engaged in storage battery testing of various kinds. He considered an automobile battery of a life of six or eight months to be something extra good. Mr. F. S. Hickok raised the question as to why end-cell switches would not be desirable for keeping an even battery voltage in a telephone exchange. His question was answered by Mr. Schuchardt by citing the experience of companies using end cells in central station work. It

was found there was considerably more depreciation of the end cells than of the others because of the difficulty of keeping the end cells regularly charged and discharged. Mr. Wray confirmed this statement as regards the use of end-cell switches in telephone work and stated he had had the same experience. The life of batteries in telephone work was given by Mr. Wray as four or five years.

Power Developments in Northern Indiana.

Capitalists of Northern Indiana, Chicago and the East are at the head of an electrical enterprise which, if successfully carried out, will prove one of the greatest steps ever taken in the industrial advancement of the St. Joseph Valley. Under the name of the St. Joseph & Elkhart Power Company, they are arranging the preliminaries for a 9000-hp electrical plant, to be built six miles above South Bend, the power to be derived from the St. Joseph River. Watervliet, Benton Harbor, St. Joseph, Niles, Buchanan, Dowagiac, LaPorte, South Bend, Elkhart and all other towns in Southwestern Michigan and Northwestern Indiana, within a radius of 25 miles, will be furnished with light and power at a rate so low that other means for operating factories and supplying light or power will be distanced. The company owns the Elkhart lighting plant and has a franchise from South Bend to furnish light and power. It is also behind the organization known as the Berrian Springs Power Company, whose legal fight with Chapin over the water-power rights in the St. Joseph River at Berrian Springs has just been terminated in a victory for the company.

Forty men, a number of teams and a 125-hp boiler and engine plant are on the ground, and the preliminary work is progressing rapidly under the most favorable conditions. No work on the dam proper will be started until spring, at which time the river will be turned from its course and on the dry bed of the stream work will be rushed to complete the structure within two months. It is not likely, however, that the plant will be ready to operate in much less than a year. The power-house will be erected on the south side of the river, at a point about three miles south of the line between Indiana and Michigan, and will be built of specially prepared concrete, which will be made on the ground and compressed into oblong bricks. The foundation will be of solid concrete, to be laid on a base of 5000 piles driven down to hard pan. The concrete itself will begin 17 feet below the present water level.

The power will be furnished by 30 large turbine wheels, connected in tandem in six units of five turbines each, the units being of approximately 1500 horse-power each. Six large three-phase alternating current generators will be connected direct to these units. The water will enter the station by a head race 2000 feet long, 800 feet wide and 15 feet deep, the channel for which is being prepared now, so that the river can follow this course when work on the dam proper is begun. A coffer dam will be built in the river below the head opening of the race, and meanwhile work will be kept up on the power station, so that it will be finished and ready for operation by the time the big dam is finished. The latter will be a trifle more than 400 feet in length and will project about 21 feet above the water level. It will be built of cement and will cross the river almost at right angles, just above what is known as Hen Island. As the back water will extend up the river nine miles and will overflow the banks, a respectable lake will result. The company has purchased outright or has leases of nearly all the property which will be affected.

In leaving the station the water will pass through a tail race 600 feet long, 100 feet wide and 15 feet deep. In excavating for this a fine quality of gravel, admirably suited for concrete work was found and will be used in the concrete for the foundation of the power station.

The construction work is being done by the Sanderson & Porter Company, of New York City, and is in personal charge of W. H. Lang, a hydraulic engineer of the same city. In order to furnish the 1,500,000 feet of sheet piling which will be used, a small sawmill plant has been installed, and the logs used are cut from the company's own land, in the vicinity of the proposed dam. To facilitate the handling of the timber a 570-foot boom was thrown across the river to catch the logs as they are floated down. A large pile driver operated by a portable engine is doing effective work in driving the stake piling to keep the high banks from caving in as the excavations are made, and will be utilized later as part of the base for the foundation of the power-house. The loose nature of the ground, the existence of quicksand and the appearance of water near the surface are making the work of excavation exceedingly difficult. The utmost precaution is being exercised and piles are being driven as closely together as possible and joined by tongues fitting into 1½-inch grooves cut in the piles, so that to all intents and purposes a solid wall is formed. The company's temporary equipment also includes carpenter and blacksmith shops, all fitted with steam-power machinery, a storeroom equipped with necessary supplies and fixtures, cement sheds, a cement storehouse with a capacity of 20,000 barrels, the amount which it is estimated will be used, and an abode for the workmen employed. A sidetrack from the Lake Shore & Michigan Southern Railway is on the grounds.

The electrical power plant will consist, as now planned, of six three-phase alternating current generators of 800 kilowatts each, and the current will be transformed at the central station to a high line potential, at which it will be distributed to the various towns and cities using the power. Sub-stations outside of these towns will step the current down to a voltage suitable for lighting distribution, and rotary converters will provide for the power current. The plant will have cost, when completed, $500,000. The St. Joseph & Elkhart Power Company was organized by James DuShane, of South Bend. The largest stockholders are the members of the firms of Beigler & Saunders, of Mishawaukee, Ind.; Thompson, Tenney & Crawford, of New York, Boston and Chicago, and Sanderson & Porter, the New York engineering firm that is doing the work.

New York Electrical Society and Electric Lighting.

The opening meeting of the 1901-02 season of the New York Electrical Society was held at the College of the City of New York, Oct. 30. There was a crowded house. Twenty-eight new members were elected. A report was read by the treasurer showing the finances of the society to be in excellent condition. Mr. F. W. Willcox, of the Edison Lamp Works, Harrison, N. J., lectured on the "Manufacture and Use of the Modern Incandescent Lamp." Mr. Willcox reviewed the whole subject of lamp manufacture, indicating and illustrating the progressive changes which have been made in perfecting the lamp and in lowering its cost to the public. The various stages in the production of the lamp were elaborately illustrated with slides, and many and various economic features of efficiency, life, etc., were discussed. It was intended that Mr. Luther Stieringer, consulting engineer of the Pan-American Exposition, should supplement this lecture by a brief address on the incandescent lamp at the Pan-American Exposition, but at the request of several of the members, Mr. Stieringer has consented to give the society a whole evening later in the season to the description and discussion of the wonderful illumination obtained at the Exposition.

Apparatus for the illustration of Mr. Willcox's admirable lecture was kindly loaned to the society by the Tiffany Glass & Decorating Company, Waite & Bartlett Manufacturing Company, the Kny-Scheerer Company, the Wappler Electric Controller Company, the General Electric Company, the New York Edison Company, the Manufacturing Electric Novelty Company, E. B. Meyrowitz, the National Electric Improvement Company, the Mason Sign Company, the Columbia Electric Supply Company, the Mason Sign Company, the Columbia Electric Supply Company, and the Electric Motor & Equipment Company, Newark, N. J. The beauty of the Tiffany lamps was a revelation even to many to whom all ordinary forms of electrical illumination are familiar.

The following members were elected: Goodrich Curtiss, 220 East 119th Street, New York; E. W. Caldwell, 315 Fifth Avenue, New York; Arthur J. Weed, 129 East Thirty-first Street, New York; C. A. Greenidge, 163 Twelfth Street, Hoboken, N. J.; W. H. Hill, 558 Metropolitan Avenue, Brooklyn, N. Y.; D. Davies, Cliffside Park, N. J.; S. G. Rhodes, 589 Walton Avenue, New York; George A. Baker, 53 Duane Street, New York; William Kohler, 25 Barrow Street, New York; W. S. Brown, 39 Cortlandt Street, New York; Charles L. Eidlitz, 1133 Broadway, New York; Albert Taylor, Electric Storage Battery Company, 100 Broadway, New York; Alfred E. Poirier, 29 West Twenty-first Street, New York; Dr. William Benham Snow, 74 West Forty-seventh Street, New York; C. H. Holden, Emerson Electric Manufacturing Company, 136 Liberty Street, New York; Charles M. Priggen, 806 Halsey Street, Brooklyn, N. Y.; Charles L. Wilcken, 269 State Street, Brooklyn, N. Y.; Dr. C. H. Tyndall, 137 South Sixth Avenue, Mount Vernon, N. Y.; Edward R. Heilig, American Electrical Works, 26 Cortlandt Street, New York; Ralph A. Schoenberg, 344 Columbus Avenue, New

York; A. J. Sefton, 55 Duane Street, New York; Caleb H. Jackson, Plaza Hotel, New York; C. S. Jackson, 55 Duane Street, New York; H. W. York, 55 Duane Street, New York; George Fulton, 471 McDonough Street, Brooklyn, N. Y.; Henry Stephenson, 55 Duane Street, New York; E. J. Kenny, 129 South Second Street, Brooklyn, N. Y.; C. J. Marsh, 56 Liberty Street, New York.

The secretary announced that the following programme of lectures for the season is proposed: Robert T. Lozier on "Modern Methods of Driving Machines and Tools Electrically"; Dr. F. A. C. Perrine on "Long-Distance Transmission"; A. J. Wurts on "The Nernst Lamp"; Professor Dayton C. Miller on "Polarized Light"; Visit to the new switchboard at Cortlandt Street telephone exchange; Dr. Kennelly on "Phenomena of Storage Batteries" and R. A. Fliess on "The Edison Storage Battery"; Luther Stieringer on "The Incandescent Lamp at the Pan-American Exposition"; visit to the new Edison Waterside station, with paper to be subsequently announced; T. C. Martin on "A Statistical Survey of American Electrical Industries"; Caryl Haskins on "Electric Meters."

Test of Farnham Third-Rail System at Chicago.

A test of a new third-rail system, invented by E. W. Farnham, one of the officers of the Chicago, Burlington & Quincy Railroad, at Chicago, was witnessed by a number of gentlemen interested in such matters at Clyde, Ill., near Chicago, on Saturday, Nov. 2. The test was reported successful. The third rail of this system is enclosed under a wooden trough covering and contact is made from beneath by a shoe carried by the truck frame. The third rail is divided into a number of sections and before entering each section the contact shoe passes under a short section of the third rail, which is free to swing with a slight endwise motion. This slight endwise motion closes a switch which supplies the section of third rail ahead of the car. When the shoe has passed from under this swinging section of rail the swinging section falls back to its original position by gravity, but the switch is held closed by a magnet in the feeder circuit as long as any current is flowing through the car when it is on that section. The switch automatically opens as soon as the current ceases to flow.

TEST OF NEW THIRD-RAIL SYSTEM.

Electro-Chemical Patents.

Several interesting patents relating to electro-chemical subjects bear date of Oct. 29. Dr. Max Haas, of Aue, Saxony, proposes to utilize the hydrogen which is liberated when alkali metal chlorides are electrolyzed to effect the necessary circulation of the electrolyte. In the electrolytic production of hypochlorite two molecules of hydrogen are set free for each molecule of the salt decomposed, and this hydrogen, admixed with a column of the electrolyte, reduces its specific gravity to such extent that an automatic circulation may be effected by the simple device illustrated in Fig. 1. A tank, *a*, subdivided by carbon plates, *e*, which constitute bipolar electrodes, is mounted within a reservoir *V*, the electrolytes in the inner and outer vessels communicating above the level of the former and also through numerous apertures, *l*, in its bottom. The carbon electrodes are mounted in insulating supports, *p*, to guard against accidental short-circuiting, and the outer tank is fitted with a cooling coil *b* by means of which the temperature may be exactly regulated. Circulation of the electrolyte occurs in the direction indicated by the arrows, the evolved gases so reducing the specific gravity of the liquid between

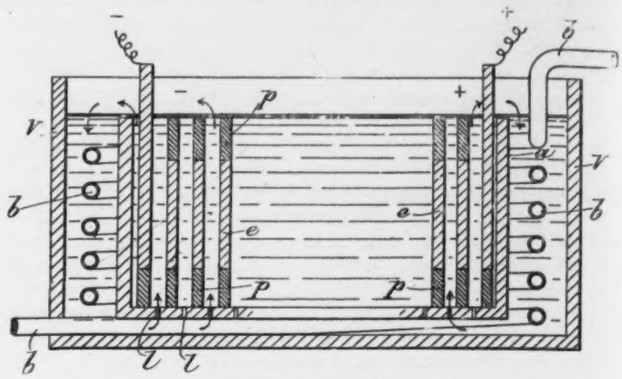


FIG. 1.—HAAS ELECTROLYTIC CELL.

the plates that it is continuously forced over the edges of the inner vessel by the solution entering through the apertures, *l*. Not only is this circulation accomplished without moving parts or expenditure of power, but it is automatically controlled, because the amount of hydrogen liberated and hence the speed of flow is proportional to the current.

Dr. Oscar Frolich, of Steglitz, Germany, seeks to solve the vexed problem of the disposal of the reaction gases from calcium carbide

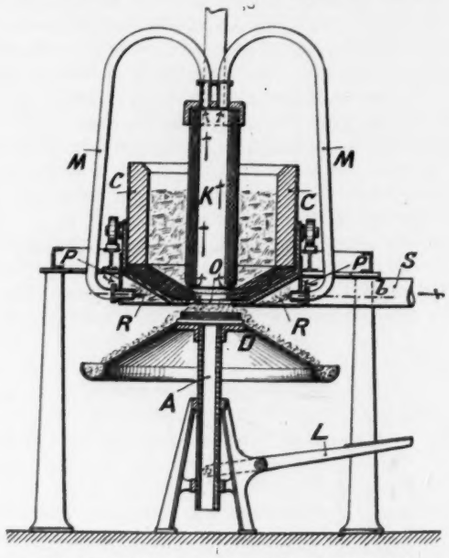


FIG. 2.—FROLICH CALCIC CARBIDE FURNACE.

manufacture by means of the furnace shown in vertical section in Fig. 2. An iron crucible *C*, having its sides interiorly lined with fire-brick and its conical bottom with carbon, forms one electrode, the

other being the carbon tube *K* hung vertically above the central taphole *O*, the disposition of parts being such that the charge gravitates through the arc onto the adjustable table *D*. Surrounding the lower portion of the crucible is a flue *R*, and in this is introduced and burned the carbon monoxide derived from the reaction and withdrawn for the purpose through the tubular electrode and the conduits *M*; air is permitted to enter the flue through openings *P*, the products of combustion escaping at *S*. The process may be either continuous or intermittent as desired, the central support *A* and lever *L* affording means for adjusting the table *D* to a position suitable for either mode of operation.

The proposal to utilize the reaction gases for heating purposes was almost the first suggested improvement in the manufacture of calcium carbide, but has never been adopted in commercial work on a large scale. The gases are laden with dust, and their utilization involves complications in the furnace which interfere with the replacement of the electrodes and the supply of the charge, and entail a disproportionate increase in the cost of construction. In all of these respects the present furnace offers advantages over prior forms. The gases are not withdrawn through the body of the charge and are, therefore, relatively free from dust, and the construction whereby the powdered mixture of oxide and carbon itself constitutes the gas seal permits an open furnace to be used, with ready accssibility for renewal of parts and for charging. If the construction of the large tubular carbons is not impracticable the furnace should prove both efficient and economical. The patent is assigned to the Siemens & Halske Company, of Berlin.

Two patents issued to Claude A. O. Rosell, of New York, and assigned to the American Lithographic Company, contain restricted claims to methods whereby zinc is electroplated upon an aluminum base in the form of an adherent yet porous deposit, suited for planographic printing. The patents derive their main interest, however, from the fact that they disclose a principle which seems to mark a distinct advance in printing of this character.

Heretofore these surfaces have been prepared by mechanically securing a thin sheet of zinc or aluminum around a cylinder and roughening it by a sand blast—a procedure entailing mechanical difficulties of a serious order. It has also been proposed somewhat recently to electro-deposit zinc upon a cylinder of copper, and after the printing of each edition to remove the coating by nitric acid and prepare the cylinder by a fresh deposit for further work. The disadvantage of this is that the acid used to remove the zinc acts slowly and unevenly upon the copper, producing irregularities in its surface, and in the end so reducing its size as to destroy the register and render it useless. Mr. Rosell proposes to electro-deposit this thin coating of zinc upon an aluminum base, preferably a cylinder accurately trued, and after development of a planographic printing surface according to known methods and use, to remove the deposit by dilute nitric acid, which is well known to be without sensible action on aluminum. A fresh deposit of zinc may then be plated out for each edition, the accuracy of register being preserved indefinitely by reason of the entire permanence of the aluminum base. Mr. Rosell finds the best conditions for producing a deposit of the required character to be the use of solutions of zinc and aluminum sulphates, or of zinc, aluminum and ammonium sulphates, rendered basic but not alakine by the addition of such reagents as ammonia, potassium carbonate or the hydrates of zinc or aluminum. The current density employed is low, varying from one-quarter to one-half ampere per square foot of cathode surface, a zinc anode being used to maintain the bath in its basic candition.

Nernst Lamp Patents.

The Nernst lamp is represented by 17 patents in the list of patents granted Oct. 29, of which 10 are fundamental patents issued to Dr. Nernst, the earliest application for these being dated April 28, 1898, and the latest Nov. 8, 1900. Of the remaining seven patents four were granted to Henry Noel Potter, two to A. J. Wurts and one to Marshall W. Hanks. As the recent paper read by Mr. A. J. Wurts before the Buffalo meeting of the American Institute of Electrical Engineers and reprinted in these pages, gave an account of the Nernst lamp as perfected up to date, much of the matter in the Nernst patents relating to constructional and circuit details may be omitted from an account of the patents.

The applications for five of the Nernst patents bear date of April 28, 1898, the titles of the patents being as follows: Method of electric lighting, electric glow lamp, electric lighting apparatus and electric glow lamps, two having the latter title.

In describing the general features of the glow lamp Dr. Nernst states that the refractory so-called rare earths when traversed by an electric current not only emit more light under the influence of a given amount of electric energy than the ordinary incandescent lamp, but also resist decomposition and disintegration even in the open air, and consequently the lamp does not require a vacuum chamber. Moreover, the general characteristic of the light-giving portion of the lamp are so widely different from those of the ordinary incandescent lamp that to term it a filament would be not only inappropriate, but to a certain extent misleading; for, aside from the light being emitted without material disintegration even when exposed to the air, the material becomes translucent and emits light both from its interior and surface. As a consequence the inventor gives the name of "glower" to the light-giving portion and "glow lamp" to the lamp itself.

The materials used, even when in their best operating conducting condition, have a specific resistance so great with reference to that of carbon that a glower to be used with a given voltage may be much shorter and thicker than the carbon filament of an ordinary incandescent lamp. For instance, a practicable glower of, say, 1/50 of an inch in diameter and ½ an inch in length, may be so made that when heated to a low incandescence it will become a sufficiently good conductor to be traversed under 100 volts difference of potential by a current of .4 of an ampere, which will be sufficient to maintain it at a state of high incandescence. As the material has sufficient strength to enable it to be used in much longer lengths than this, it is possible to construct lamps adapted to be operated at very much higher voltages than are practicable with lamps using carbon filaments.

It is stated that very excellent results have been obtained from a mixture of approximately 70 per cent of zirconia and 30 per cent of yttria (oxide of yttrium); another mixture which has been used with good advantage consists of approximately 10 per cent of zirconia, 70 per cent of thoria and 20 per cent of yttria; another mixture given is 70 per cent of thoria and 30 per cent of yttria, and still another consists of .5 per cent of ceria, 80 per cent of thoria and 19.5 per cent of yttria. It is stated that these percentages may be widely varied, and generally speaking, the oxides of the rare earths are well adapted for mixture in widely varying proportions.

In preparing the glowers the two or more oxides used are thoroughly pulverized and mixed with a binder of clear starch paste, from which the glowers are "squirted" by the same process used in making carbon filaments. After drying the glower is heated to a very high temperature, for example, in an oxyhydrogen flame, preferably after a preliminary heating in a porcelain kiln. The specifications describe means for making a junction between the ends of the glower and the conducting wires, a form of starting heater and the use of a ballast wire, the object of the latter, it will be remembered, being to introduce a resistance which increases with flow of current and consequently increase of temperature, in order to compensate for the reduction of the resistance of the glower with increase of temperature and current. As the Wurts article describes in detail the latest forms of these two latter devices, and we have recently printed accounts from patents of methods of making terminal connections which apparently supersede those first suggested, it is unnecessary here to consider these parts of the specification.

Reference is made to a patent by Jablochkoff, which suggested the use of so-called electrolytic conductor in electric illumination. The patent suggests the possibility of heating the edge of a kaolin strip or plate placed between two electrodes separated by an intervening air space and employing the electric spark of a induction coil. Dr. Nernst says that such a method has not been found capable of commercial use and differs from his method and lamp because of the facts, among others, that kaolin is easily melted, that his illuminant is primarily brought to a conducting temperature throughout its mass and not merely along a line or portion thereof, and that his lamp permits the use of currents of much lower pressure. In certain publications relating to the Jablochkjoff candle it is also suggested that the heating of the upper part of a porcelain plate might be brought about by applying thereto a surface coating of gum and carbon, or by using some other temporary expedient for leading the spark across the edge of the plate. Dr. Nernst says that these suggested constructions are not commercially practicable, and are also lacking in a heating conductor which is a permanent part of the structure and capable of repeated use. The Jablochkoff devices, he says, are not

heating devices, but merely devices in the nature of switches for starting the arc.

The patent from which the above has been abstracted contains six claims on the method of operating an electric lamp having a glower composed of dry electrodes, and in the method of developing light by the incandescence of a refractory body.

The second patent in serial number, which contains the same specifications as the one just considered, has 44 claims relating to all the various elements of the Nernst lamp, and particularly to details of the heater, including means for automatically cutting the same out of circuit. The two following patents relate also to the electric heater, covering specific forms and heater circuits. The claims of the fifth and last of the earliest patents in date of application relate to the means for joining glowers to metallic terminals.

The sixth and seventh patents in serial order are on applications filed Aug. 24, and cover different mixtures of materials from which the glower is formed, as follows: Eighty parts of oxide of zirconium and 20 parts of a mixture of the rare earths of gadolinite; 80 parts of the oxide of zirconium and 20 parts of a mixture of the rare earths of the yttria group in such proportion as occur in gadolinite; 80 parts of the oxide of zirconium and 20 parts of a mixture of gadolinite and the rare earths commonly associated therewith in nature after removing the portion of those belonging to the ceria group; 85 per cent of zirconium and 15 per cent of one of the other rare earths; 85 per cent of zirconium and 15 per cent of yttria; a mixture of the rare earths containing approximately 85 per cent of zirconium.

A patent for which an application was filed Sept. 29, 1899, describes a divided ballast consisting of a portion enclosed in an air-tight chamber, which is standardized as perfectly as possible, and an auxiliary adjustable exposed ballast adapted to compensate for any inequality due to the peculiar conditions of each glower.

The two final Nernst patents were granted, one on an application filed Aug. 24, 1899, and the other on an application filed Nov. 8, 1900, and both relate to the composition of the material of the glower as follows: In the first-mentioned patent the mixture claimed is 80 parts of oxide of zirconium, 10 parts of oxide of erbuim and 10 parts of the oxide of yttria. In the second patent the mixtures claimed are 80 parts of oxide of zirconium and 20 parts of a mixture of those metals of the yttria group which occur in an yttria containing mineral; a predetermined per cent of the oxide of zirconium and a mixture of the rare earths of the yttria group in such proportions as they are found associated in nature; a preponderance of zirconia, together with such of the rare earths of the yttria group as are contained in yttria containing materials, in the approximate proportions that such earths are found therein.

Of the four Potter patents, one for which application was filed Aug. 9, 1899, relates to the operation of a heater by means of magnetic or thermostatic devices included in a shunt circuit to the glower. As the glower becomes conductive the increased current through the ballast wire in series with it operates a thermostatic device, which makes a contact whereby the heating device is withdrawn from proximity to the glower by a solenoid. Another patent, for which application was filed Sept. 11, 1899, relates to a heating device for electric lamps, consisting of a plurality of heaters disposed in parallel lines adjacent and at right angles to the glower or glowers and connected in parallel. A third patent, of which the application is dated July 14, 1900, is on a means for automatically cutting out the ballast conductor when the voltage increases materially beyond the normal, this being accompanied by a solenoid which causes a contact to be made that short-circuits out the ballast device. The fourth Potter patent is on an electromagnetic heater cut-out, which has two coils primarily connected in series with the glower, one of which is short-circuited after the heater circuit is broken. By this arrangement the heater circuit is interrupted before the glower takes sufficient current to render the heater and glower current dangerous to other lamps in series, and the short-circuiting of a part of the magnet winding leaves only sufficient winding in circuit to maintain the heater circuit in open condition.

Of the two Wurts patents, the application of one was filed Feb. 21, 1900, and that of the other April 17, 1901. The earlier patent describes an arrangement of a Nernst lamp in portable form for use upon desks and tables. The mechanism is enclosed in a tube bearing some resemblance externally to a wax candle; the glower is supported on a stem which projects from this imitation candle, and located above it are the heater tubes, which are so arranged as to constitute a downward reflector for the light. The second Wurts patent is on an electromagnetic heater cut-out. When current begins to flow in the glower a magnet is energized, which attracts a ball, thereby interrupting a circuit which had been closed by the ball being seated over a gap in the circuit.

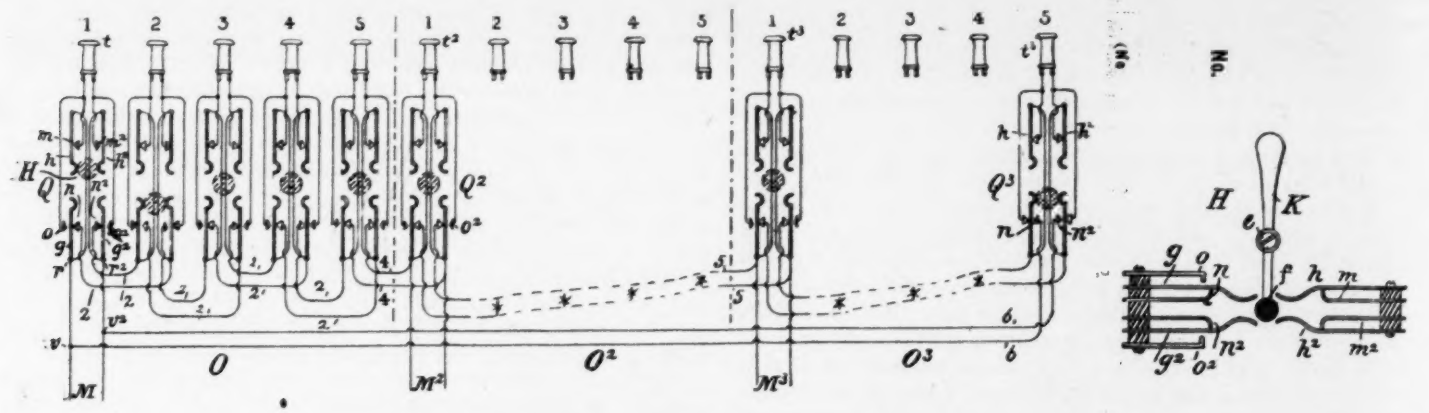
The Hanks patent is on a method of treating Nernst lamp glowers whereby they may be adapted to circuits of a given voltage. This is done by maintaining the glowers at an elevated temperature by passing a current through them, and at the same time subjecting them to a cloud of powdered material, the composition of which is the same or similar to that of the glower bodies.

New Telephone Patents.

Among the issue of the Patent Office for Oct. 29 is a grant to Frank A. Cumings, of Greersville, Ohio, on a "secrecy telephone system," which is a device adaptable only to series party lines. By means of a switch joined by a connecting-rod to the regulation switch-hook the bell and generator are cut out of circuit, and by means of a separate switch, operated by hand, the line can be grounded on either side of the station in use, thus cutting off the stations beyond. In these days of highly complicated circuits the device of Mr. Cumings appeals to one by reason of its refreshing simplicity; the series grounded circuit party line is, however, chiefly confined to rural districts and rural use of the grounding switch might be expected to cause a lack of harmony among the users of the line.

Another patent that arrives rather late on the scene, in view of the present state of the art, is granted to Ernest Krahenbuhl, of San Rafael, Calif., on a treadle device for operating power generators by foot, for use at the switchboards of telephone exchanges. This is particularly adapted for use at small exchanges in localities where power is not obtainable or is too expensive.

A patent granted to A. S. Hibbard, the general manager of the Chicago Telephone Company, is on a "universal" call-circuit and apparatus for handling toll-service. As is generally known, modern practice in handling toll-service—an important part of the work of all



FIGS. 1 AND 2.—TELEPHONE TOLL-BOARD OPERATION.

large telephone systems—consists in the maintenance of a special toll-board, at which the toll lines centre, connected by trunks and call-wires with the various exchanges of the system. The call for a toll connection is passed to a recording operator, who makes out a ticket for the call, which ticket is passed either by a messenger or by mechanical means to a connecting operator, who proceeds to establish the connection, first getting the distant subscriber and then going back to the originating subscriber on an incoming trunk. This requires the work of two and sometimes of three operators at the toll board on each connection, and the passing of message tickets to and fro, with the consequent risk, slight as it may be, in a well-managed office, of confusion and error.

The object of Mr. Hibbard's invention is to enable a single operator to take entire charge of each message passing through the toll-room and to carry out the various sub-operations concerned in the establishment of the connection, thereby expediting the service, dispensing with the circulation of the ticket and minimizing the chance of error. This object is attained by connecting the call-wires (over which orders for toll service are received from the various exchanges in the system) among groups of operators in such a manner that the operators may switch into the call-wire, cutting off the wire beyond, bridge on to the call-wire to determine if it is in use, or cut out of the call wire altogether. This is accomplished by passing the call wire through a three-position switch connected to the toll operator's telephone set. With the switch in one position the operator is connected to the call-wire and the call-wire is cut off beyond her, so that she has the exclusive use of it for the time being; with the switch in the second position the operator is disconnected entirely from the call-wire and the call-wire is in a state of continuity; with the switch in the third position the operator is bridged on to the call-wire and can listen to orders.

This arrangement results in the operators being practically in line on the call-wire. The first operator, on receiving a call, makes out the toll ticket and then throws her switch so as to disconnect from the call-wire, which is then automatically passed on, as it were, to the next operator, who normally has her switch at the connect position. Thus each operator receives calls in turn, goes out of circuit with the call-wire to establish the desired toll connection, and leaves the next operator in line on the call-wire. In coming back on the call-wire the operators turn the switches to the bridging position to make sure that no order is being transmitted at the moment, before turning the switches to the "connect" position to place themselves back in line on the call-wire. It may occur that all of the operators of a group have received orders and are all disconnected from the call-wire and engaged in completing connections. To give each call-wire access under such conditions to other operators, the contacts of the last switch of a group are connected to some one of the other call-wires at the board, so that all the operators normally serving one call-wire being out of circuit, that call-wire is temporarily extended to another group, and so on.

The accompanying diagrams (Fig. 1) show the arrangement of call-wires, switches and operators' telephones, and Fig. 2 shows the details of the switch or circuit changes. In Fig. 1, M, M^2 and M^3 are call-wires. O, O^2 and O^3 are groups of operators, and Q. Q^2 and Q^3 are loops in which the operators' telephones, t, t^2, t^3, are connected. H is the circuit changer, shown fully in the first group, but indicated by stars in the other groups. From Fig. 2 the operation of the system can be clearly seen. The call-wire is connected to springs g, g_2, h and h^2; the operator's telephone is connected to O and O_2, m and m_2, and the switch is connected to the succeeding switch from springs n and n_2; thus, if the switch handle is moved to the right g and g_2 break contact with n and n_2 and make with O and O_2, thus puting the telephone in circuit and cutting off the call-wire from the next switch; if the switch is moved to the left h and h_2 break contact with m and m_2 and the telephone is cut off from the call-wire altogether, the call-wire being left in continuity by the contacts between g and n, g_2 and n_2. In the middle position of the handle the telephone is bridged on at h m, h_2 m_2 and the call-wire is continuous.

In Fig. 1 it will be seen that operator No. 1 has cut out of the call-wire to make a connection, No. 2 has connected with the call-wire and so cut it off from the succeeding operators, and Nos. 3, 4 and 5 are bridged on, waiting to come into line.

Mr. Hibbard's system promises an advance in methods of toll-board operation.

CURRENT NEWS AND NOTES.

THE NEW ORLEANS LEVEE LIGHTS.—It is stated that the arc lights along the famous levee at New Orleans have broken up completely the last remnants of the old gangs of thieves that were a terror there. Now some 60 policemen guard it easily, and a newspaper can be read at night all the way.

VELOCITY OF LIGHT RAYS.—The Franklin Institute has renewed its offer of the Boyden prize for an answer to the question whether all rays of light and other physical rays are, or are not, transmitted with the same velocity. This prize has been before the public since 1859, and the original amount of $1,000 has by accumulations of interest increased to over $3,000.

STANDARDIZATION OF EXTRA HEAVY FLANGES.—During the summer a committee representing a number of valve and pipe-fitting manufacturers prepared specifications for the details of extra heavy flanges of pipes, fittings and valves, and these specifications have been formally adopted by the leading manufacturers of the United States. The specifications cover the diameter and thickness of flange for different sizes of pipe, the diameter of bolt circle and the number and size of bolts. The rules will go into effect Jan. 1, 1902.

CENTRAL STATION INSURANCE.—At the recent meeting in Rock Island of the Illinois State Electric Association a letter from Mr. Frey, chairman of the committee on insurance, was read, giving the result of the investigations of the committee as to the conditions of central station insurance. Seventy-six replies to a circular were received from Illinois stations, 56 companies reporting $1,247,350 insurance, of which $206,500 was carried by mutuals; 20 companies reported no insurance. Among the companies carrying insurance, 46 had brick stations and 10 frame, the average rate paid by the former being $1.50, and by the latter $1.10. The average insurance among these plants is not over 40 per cent. The investigations showed that considering the expense of inspection and the rate charged by the mutual companies, the expense of insurance in these companies would equal that in the old line companies. The report advised the organization of a central station mutual company, saying that with such a company from 25 to 50 per cent could be saved. No success attended the efforts to obtain a reduction of insurance rates from old line companies. In the discussion which followed the concensus of opinion was that it was not practicable to form a mutual company, and that central station plants paying a high insurance rate should make such changes and adopt such dispositions as would reduce the fire risk, in which case a lower rate could be accorded them.

MARINE WIRELESS TELEGRAPHY.—According to our London contemporary, the *Electrician*, the Lloyds' (marine underwriters' association) have entered into an important agreement with the Marconi International Marine Communication Company. According to this agreement, Lloyds will employ no other system of wireless telegraphy than that of the Marconi Company for a period of 14 years; they will receive commercial messages at their signal stations from any vessel equipped with the Marconi apparatus, and will also send messages to any such vessel; but they will receive or transmit no wireless telegraph communication whatever where a vessel is equipped with apparatus not supplied by the Marconi Company. It is provided by the agreement that wherever a centre for commercial wireless telegraphy with ships would be advisable, the existing Lloyd's stations at these points shall be worked on the Marconi system; or, if no station exists within about 20 miles, a new Lloyd's station will be erected at a convenient point, and, of course, be placed in ordinary telegraphic communication with the post-office lines. Arrangements have been made by which Atlantic liners fitted with Marconi apparatus will be supplied with all the latest important news as soon as they come within about 100 miles of America or the British Islands; and, in course of time, the same will be done for liners on other ocean routes. As regards the revenue which the Marconi Company expects to derive from these operations, we understand that a tariff system is being adopted in place of the rental system formerly in vogue. Signal stations are allowed free use of the apparatus for the ordinary receipt of Lloyd's signals, and vessels signaling to one another are permitted a certain number of free service messages, but

for all commercial messages a charge of 6d. per word, in addition to land charges, etc., is made for each wireless transmission.

THE ENGLISH PUBLISHERS of Fitzgerald's "Lead Storage Battery" regret that, owing to fire which occurred in their bindery, almost the entire sheet stock of this work was destroyed, and that, at least for some little time to come, they will be unable to supply copies.

PHILIPPINE CABLE RATES.—The Commercial Cable Company announces reduced rates to the Philippine Islands. We are advised that the following rates go into effect on and after the 15th inst: Luzon Island, $1.66 per word from New York; all other islands, $1.76 per word from New York.

CLOSE OF THE PAN-AMERICAN.—The Pan-American Exposition, at Buffalo, closed on Saturday night, Nov. 2. The total attendance was 8,350,000, but the receipts are about $3,500,000 short of the expenditures. It is universally agreed that it will be remembered in history by the dastardly assassination of President McKinley and by the wonderful electrical display at night, attaining with the aid of current from Niagara a beauty and magnificent never before reached.

TELEPHONE WAR IN PHILADELPHIA.—It would appear that the telephone war in Philadelphia is now on in earnest. The Bell Company has announced a new schedule of rates for next year, brought about by prospective competition and the comparatively lower rates of the new Keystone Telephone Company. Illustrative of the Bell reductions for a limited service and party-line rates are the following: The old rate for business houses special circuit was $90 for 900 calls and six cents for each additional call; new rate, $69 for 800 calls and five cents for additional calls. For a two-party circuit: Old rate, $60 for 600 calls; new rate, $48 for 600 calls.

NERNST LAMPS IN THE CONNECTICUT STATE CAPITOL.—A contract has been awarded for wiring the capitol at Hartford, Conn., on the basis of 3931 incandescent lamps. Incandescent, arc and Nernst lamps are to be used in proportions to be subsequently decided upon. A particular feature will be the interior and exterior illumination of the dome. For the interior 836 incandescent lamps, or their equivalent, will be used. At the top of the interior of the dome a large Nernst lamp will be installed, and probably many more of these lamps will be used in the dome. Three hundred and seventy-two incandescent lamps, or their equivalent, will be placed on the exterior of the dome. Directly under the railing at the top there will be a circle of 36 Nernst lamps.

ST. LAWRENCE RIVER LIGHTING.—A special dispatch from Ottawa, Ont., of Oct. 30, says: "An important patent connected with the St. Lawrence navigation has been railroaded through the patent branch, application being made at noon yesterday, and the patent issued to-day and submitted to Minister of Public Works Tarte, by whom it will be laid before the Cabinet. The patent is designed specially to do away with the lighthouses, buoys and the entire paraphernalia for night navigation between Montreal and Quebec and substitute a submerged electric system which, however, will apply to all inland navigable waters. The main idea is to sink an electric cable in the center of the navigable channels, with power transmitted from a power-house at Montreal, and lines of colored lights at or above the water level, each side of the channel, the lights on one side being of a different color from those on the other side, and supported by cork floats. The patentee is H. J. Cloran, Mayor of Hawkesbury." Very similar work, however, has been done for years in Gedney Channel, New York Harbor.

SPEED AT ZOSSEN.—A newspaper dispatch from Berlin of Oct. 13, says: "The Kaiser is much disappointed to-day over the failure of the German engineers to get more than 73 miles an hour out of electrical cars on an experimental track from here to Zossen. Double that speed was expected." As the Zossen trials have just commenced, and the speed tests were only to be undertaken after every detail of the car equipment and collecting system had been tested out and remedied where found defective, it is somewhat premature to anticipate final results at the present time. Since the above was written a later cablegram reports that the Zossen trials have been entirely successful. It is stated that the speed of the trains has been gradually increased until now 85 miles are comfortably covered in the hour. The cars run smoothly and the engineers express confidence that they will attain a speed of 125 miles an hour. The wires have been tested to a capacity of 14,000 volts, but hitherto only 8000 volts have been necessary. It is expected that a voltage of 10,000 will suffice to give a speed per hour of 125 miles.

CONSTANT E. M. F. FROM A VARIABLE E. M. F.—A patent granted Oct. 29 to Norman W. Storer relates to means for maintaining a constant voltage at a translating device, such as a storage battery, on a circuit having a variable voltage. Assuming a storage battery to be the translating device to be supplied with a constant voltage, in series with it is the winding of one of three armatures mounted upon a single shaft. The first-mentioned armature is provided with a series field winding, and an auxiliary winding, referred to below. A second armature is connected across the main circuit and provided with a shunt field which is saturated under conditions of normal operation. The third armature is also provided with a shunt field so proportioned that the iron of the latter shall always be worked at a point well below saturation. The latter armature is connected at one side to a conductor of the main circuit, and at the other side to one terminal of an auxiliary winding on the field of the first-mentioned armature, the other terminal of which is connected to the other conductor of the main circuit. The armature with the saturated field will always respond quickly to all changes in the voltage of the main circuit. These changes in speed being imparted to the armature having a non-saturated field, the e. m. f. supplied by this armature to its circuit will vary rapidly with such changes, and thus will vary the excitation of the field magnet of the armature connected in series with the storage battery, and therefore also vary the e. m. f. impressed by the latter armature upon the storage battery circuit. By a proper proportioning of the windings this variation of the e. m. f. may be made such as almost to equal the difference between the e. m. f. of the main circuit and the constant e. m. f. in the storage battery circuit. This difference will be either a boosting or a counter e. m. f., depending upon whether the main circuit voltage is less or greater than the constant voltage desired.

A NEW THERMO-ELECTRIC COUPLE.—In 1827 Becquerel the elder investigated the thermo-electric relation between copper and its sulphide and later Becquerel's son constructed thermo-electric couples of copper sulphide in contact with copper or German-silver. By reheating bars of melted copper sulphide for several hours, he found that the thermo-electric power became more regular, and he constructed a thermo-electric battery in his laboratory with bars of fused copper sulphide thus obtained, covered at their ends with coils of copper or German-silver, which gave an e. m. f. relatively much higher than that given by any other thermo-electric couple known. Unfortunately, the natural resistance of this type of battery is so great that it was inappropriate for any practical use. Two patents granted Oct. 29 to Eugene Hermite and Chas. Friend Cooper, of Paris, France, relate to overcoming this difficulty, and also that of making contact between the copper sulphide and the metal employed therewith which shall be indestructible by heat. The copper sulphide is first melted, then cast in the form desired; the pieces thus obtained are next placed in a crucible heated to redness, in which they are submitted to the action of sulphur vapor for about half an hour. After being taken out and cooled, they are again put back into a closed furnace and heated to bright redness for several hours with exclusion of air, some ingots of copper being placed in the furnace to absorb the sulphur vapor evolved. After this operation the resistance is found to be greatly decreased, and every piece gives a perfectly regular e. m. f. of from .2 to .3 of a volt. It is also advantageous to add from 1 to 5 per cent of sulphate of iron to the copper sulphide. It has been found that the most advantageous metal to use in contact with copper sulphide in the construction of thermo-electric couples, is brass. Minute instructions are given in the patent concerning the operation of securing the brass to bars or tubes of copper sulphide, and also for mounting the couples in a protecting casing.

LETTER TO THE EDITORS.

Wireless Telegraphy.

To the Editors of Electrical World and Engineer:

Sirs.—From time to time there have appeared in print accounts of wireless telegraphy experiments, in which two signals have been sent simultaneously without interference. Now, it is well known that from an aerial wire, no difference what its length, the waves are sent

out in every direction, and any well-constructed receiver within reach will pick up the waves.

What effect could a receiver in tune with a certain sender, simply because it was in tune, possibly have on some other receiver at a distance not in tune? And if two receivers are in tune, would not a receiver not in tune with a particular sender be in tune with some other, possibly still unconstructed, sender? And if the latter does receive the waves sent out, is it possible that the one in tune, simply because it was in tune, will receive no other waves than those from that particular sender? Another thing that appears to me to be somewhat doubtful is the statement that a certain fixed condenser capacity and no other, properly attached, will put a sender and receiver in tune. I find that by using a condenser with one of its sheets of tin-foil attached to one side of the induction coil's secondary, and the other sheet earthed, that with the rotating disks described in a former article, the condenser exerts no varying effects when its capacity is varied. A small capacity being sufficient to contain one side of the impulse, positive or negative, from a transmitting coil, if enlarged, it will still hold the one side of the impulse, and the increase of capacity is without effect, excepting possibly involving more dissipation of the charge before discharge is made.

It is not like charging a Leyden jar with an influence machine, where there is a stream of impulses, positive or negative, to be accumulated before discharge; but rather a single accumulated one-side impulse, positive or negative, and then a discharge toward the side without condenser.

ALFRED G. DELL.

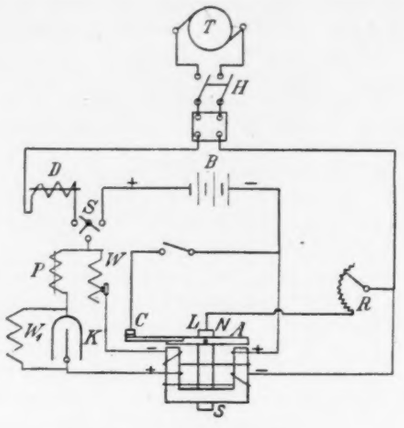
BALTIMORE, MD.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS

Leblanc Converter.—FELDMANN.—A well illustrated description of a new converter devised by Leblanc. It consists of a stationary transformer of special construction, a stationary collector the segments of which are connected to the secondary coils of the transformer, and a small synchronous motor for revolving the brushes around the collector. These three essential parts are placed in one casing. This converter transforms 3500-volt, two-phase currents into 120-volt direct current. When combined with a synchronous motor, which takes care of the wattless currents supplied from the line to the converter, the converter transforms 3500-volt single-phase currents into 120-volt direct current without sparks at the commutator. If the converter is to be used for transforming direct current into single-phase or two-phase currents, it must be used in both cases in combination with the last mentioned synchronous motors which then acts as a storage of energy. The special feature of the converter is the stationary transformer part, which is quite complicated. Besides the primary and the secondary windings there are two "compensating windings." The primary windings are connected to the line, while the secondaries are connected to the segments of the stationary commutator, in a manner similar to the construction of direct-current machines. The synchronous motor, which has to take care of the wattless currents, as mentioned above, must have the same capacity as the converter when used for single-phase. The article is well illustrated by figures and diagrams, and Leblanc's theory is given. Such a 16-pole, 60-kw converter of this type has been built by the Helios Company, and the results of tests were in full agreement with the theory.—*Elek. Zeit.*, Sept. 26.

Charging Storage Batteries from Alternating-Current Mains.—F. J. KOCH.—An illustrated article on "A new system of getting direct current from alternating-current mains." If an alternating current with sinusoidal e. m. f. is converted by means of a synchronously revolving commutator, the e. m. f. of the current has a wave form which consists of a series of half sine waves of the same polarity. the e. m. f. pulsates continually between zero and a maximum. Such a current is not adapted for charging a storage battery. Only those parts of the wave of e. m. f. are adapted for this purpose, in which the e. m. f. is greater than the counter e. m. f. of the battery. The other parts of the current must be cut off by the commutator. The current which is supplied from the commutator to the battery, has, therefore, the following waveform. It increases from zero to a maximum and decreases to zero, remains zero for an interval, increases then again to a maximum, and so on. He describes a commutator devised by him for this purpose. It is somewhat similar to a polarized relay. A special feature is the use of a condenser to counteract the effects of the self-induction of the coils of the commutator. To adjust the capacity and the self-induction relatively to each other, he varies the self-induction by means of an auxiliary choking coil, the iron core of which is movable. He claims that his commutator interrupts and closes the circuit exactly at those moments when the e. m. f. of the current supplied from the commutator is exactly equal to the converter e. m. f. of the battery. There are, therefore, no sparks at the point where the contact is made and broken. The arrangement is shown in the adjoining diagram. *T* is an alternator, *B* is the battery to be charged, *C* is the point where the contact is made and broken, *P* is the choking coil, with adjustable self-induction, and *D* is the main choking coil. *K* is a condenser, shunted by the choking coil W_1. The magnet arms have two windings, one supplied with current from the battery, the other from the alternating-



CHARGING STORAGE BATTERIES.

current mains. By properly adjusting these windings contact may be made only by the surplus of the alternating e. m. f. of the mains over the counter e. m. f. of the battery.—*Elek. Zeit.*, Oct. 10.

Aluminum Rectifier.—MITKIEVIEZ.—An illustrated article in which he expresses the opinion that the electrode of an aluminum rectifier practically represents a large number of Wehnelt interrupters mounted in parallel. The glow on such an electrode resolves itself under the microscope into an infinite number of minute luminous stars, making as many punctures of the thin film of aluminum oxide, which covers the electrode. If the analogy holds good, it is not surprising that one phase of an alternating current is suppressed, since Wehnelt's interrupter does the same. In an aluminum rectifier it is not necessary to use a large aluminum surface. He uses an aluminum wire, cleaned by scraping with a knife and a lead cylinder, as electrodes in a solution of bicarbonate of soda.—*Phys. Zeit.*, Sept. 28; abstracted in Lond. *Elec.*, Oct. 11.

Variable Speed Direct-Current Motor.—An illustrated description of a device of Ziehl, by which the speed of a direct-current motor can be varied in wide limits, while the efficiency is only slightly changed. This is accomplished by producing a special counter e. m. f. in the armature and thereby diminishing the voltage of the current received, hence, according to the value of the special counter e. m. f. in the armature, the speed of the motor is varied without influencing the efficiency considerably. The special armature winding for producing the special counter e. m. f. consists of several parts of which any may be made active or inactive, to adjust the speed.—*Elek. Rund.*, Oct. 1.

Tramway Generators.—Dettmar.—A communication criticizing Hobart's comparison of American and European specifications for tramway generators, the requirement in the United States being more rigid than in Europe (Digest, Sept. 14). The present writer claims that this comparison is unfair, as the specifications, given as usual in Europe, represent only the least requirements which must be fulfilled under any circumstances. He says that the actual machines of German make are much better and very often attain the requirement of the American specifications.—*Elek. Zeit.*, Oct. 3.

Lights and Lighting.

Illumination Effects by Means of Electric Sparks.—Soulier.—When high-frequency currents are used in combination with condensers to produce sparks, the spark discharge, instead of appearing in a brilliant form, often takes the form of an arc which closes the circuit by a small resistance and does not allow the Hertzian phenomena to take place. To prevent this it has been proposed to extinguish the arc by an air current, but this requires special apparatus and a large consumption of energy. D'Arsonval has instead devised the following arrangement: He revolved rapidly the two metallic globes which form the spark-gap. This produces an air current which extinguishes the arc, and a beautiful illumination effect is obtained, in form of a circle of brilliant sparks.—*L'Ind. Elec.*, Oct. 10.

Reference.

Train Lighting.—Prasch.—A continuation of his illustrated serial in which he deals with the systems of Dick, Auvert and Kennedy's Columbian system.—*Elek. Neu. Anz.*, Oct. 1.

Power.

Pumping Plant.—In a continuation of the serial on the recent visit of the Brit. Inst. of Elec. Eng. to Germany, a description of the underground pumping plant in the Zollverein coal mine near Essen, Germany, is given. The mine is 400 meters below the surface, and 3 cubic meters of water are pumped per minute to its height. The pump is a duplex differential pump running at the slow speed of 62 r. p. m., and is directly coupled to a 350-hp, three-phase induction motor, supplied with current at 1000 volts and 25 p. p. s. The motor weighs 30 tons, and it was difficult to take it down the shaft and erect it. The motor has been in use for three years, and the installation was very satisfactory.—Lond. *Elec.*, Oct. 11.

Electric Installation of a Sluice.—An illustrated description of the electric power and light installation of the sluice at Poses-sur-Seine, France. The River Seine divides there into two arms, and there is a wear-head, 12 to 30 horse-power being available. There is one turbine and two dynamos, each giving 40 amperes at 275 volts, also a storage battery of 54 cells, with a capacity of 200 ampere-hours. The three-wire system for lighting the sluice is separate from the power circuit for operating the doors of the sluice.—*Le Genie Civil*, v. 39, No. 17; abstracted in *Zeit. f. Elek.*, Sept. 29.

Portable Electric Drill.—A well illustrated description of an electric drill of German make. It is entirely self-contained. The drilling spindle is 2.4 inches diameter, with a stroke of 12 inches, and drills holes up to 3¼ inches diameter. It can drill at any angle in a vertical circle. A 2-hp motor is mounted on a bracket at the end of the horizontal bar. It makes 1250 r. p. m., and drives a second shaft with worm, which transmits through back gear to the drill spindle. The four-step cone is used. It is made for a wedge belt.—*The Eng.; Sc. Am. Sup.*, Oct. 12.

References.

Superheated Steam in Engines.—Lenke.—A Glasgow Int. Eng. Congress paper, giving some experiences and results derived from the use of highly superheated steam in engines.—Lond. *Elec.*, Oct. 4.

Crane.—An illustrated description of a 150-ton electric crane, installed at the new repair basins of the port of Bremerhaven, Germany.—*Sc. Am. Sup.*, Oct. 19.

Traction.

High-Speed Railways—Dolezalek.—A long abstract of a paper, in which he discusses the problem of the construction of high-speed railways. He does not believe that the present track construction of railways can be used, nor the monorail system of Behr. He says much in favor of suspended railways of the Langen system, such as the railway between Barmen and Elberfeld. He recommends building the suspended railways for very high speeds directly above the tracks of the present railways. The slow-speed accommodation trains are to be operated with steam as before, but the high-speed suspended railways are to use electricity. He points out the practical advantages of such an arrangement.—*Elek. Zeit.*, Oct. 3.

Electric Automobile.—Mueller.—The conclusion of his serial on the problem of electric automobiles, the first parts of which were abstracted before in the Digest. He says that this problem is not yet solved. He gives, however, the following general rules for the construction. The wheels should have large diameters. The wheels and axles should be light and as much as possible free from other parts of the construction. The carriage springs should have a large variation of form with a small variation of load. The upper part of the automobile with all its accessories should be a self-contained unit. He remarks that while these rules are not followed in the German automobile industry, certain types of American automobiles fulfill them nearly.—*Centralblatt f. Accum.*, Oct. 1.

References.

Tramway Power Calculations.—Hausard.—A sheet giving a tramway tractive effort and power diagram; also a brief explanatory article. Logarithmic scales are used in the preparation of the diagrams which appear to be quite handy. It gives the following information. First, given the weight of the car and the gradient, the draw-bar pull is shown. Second, taking into account the speed, the brake-horse-power required to drive the car may be found. Third, if the efficiency of the electric equipment is known, the kilowatts to be supplied to the motors are shown, the column for which is also scaled in "amperes at 500 volts."—Lond. *Elec.*, Oct. 11.

Wheels for High-Speed Railway Cars.—Reymond-Schiller.—A communication in which he discusses the mechanical construction of the wheels for high-speed railway cars, to ensure safety.—*Elek. Zeit.*, Sept. 26.

Load Factors.—Booth.—An article on the station load factor, i. e., the ratio of the mean station output in a given time to the maximum output. He refers especially to traction stations and discusses the relation between the load factor and the number of cars running.—Lond. *Elec. Rev.*, Oct. 11.

British Tramways.—A well illustrated description of the Croydon municipal electric tramways. The overhead trolley equipment is on the side bracket system.—Lond. *Elec.*, Oct. 4.

Automobile.—Petot.—A French Academy note, of a mathematical nature, on the action of the brakes of automobiles.—*L'Ind. Elec.*, Oct. 10.

Installations. Systems and Appliances.

Charging for Electrical Energy.—De Fodor.—A communication on methods of charging for electric current. He has determined for 12 years the annual time of use of a kilowatt, connection to the station, and he has found that for a certain class of consumers the annual time of use is nearly constant. He divides the consumers into three classes. First, large consumers with which the station has to make special agreements; second, stores, offices, etc.; third, smaller private consumers. For the latter two classes he bases the tariff on his statistical data which state that each kilowatt connected to the mains should be used for so and so many hours per year for each of these two classes. For the hours above these statistical average values he allows discounts which differ according to the time of the year, less in the winter and more in the summer. He thinks that the maximum demand system is unjust.—*Elek. Zeit.*, Sept. 26.

British Lighting and Traction Plant.—An illustrated description of the Croydon municipal plant. For lighting, alternating current is generated at 2000 volts and transformed down to 200 volts in 26 substations. The outlying districts are fed at 5000 volts alternating current through cables. Ferranti rectifiers at the plant convert alternating into direct current for lighting 62 arcs in the central thoroughfares. The more remote districts are lighted by means of low-pressure enclosed arc lamps supplied with alternating current from the same mains as are used for private lighting. For traction the overhead trolley system is used. It is proposed to supply the central portion of the town with direct current for lighting, and a considerable motor load is expected. An interesting feature is the control of the public lighting over an area of 12 square miles by means of a selector system which utilizes the pilot wires as well as the telephone wirs. By this means the whole of the arc lighting, some 400 lamps, can be switched on or off the central station in very few minutes.—Lond. *Elec. Rev.*, Oct. 4.

REFERENCES.

German Three-Phase Plant.—In a continuation of the serial on the recent visit of the Brit. Inst. of Elec. Eng. to Germany, an illustrated description of the Essen station is given. There are four generating sets, two of 1000 kilowatts and two of 500 kilowatts, all generating current at 5000 volts and 50 p. p. s. The station supplies a three-phase motor load and three-phase lamp circuits. Three wires are led into all the consumers' premises except the very smallest. Some 300 motors aggregating 4000 horse-power, and about 30,000 lamps are connected to the mains.—Lond. *Elec.*, Oct. 11.

Lausanne.—TAEUBER.—A well illustrated article on the generating station and converter station "Pierre de Plan," of the electric works of Lausanne in Switzerland. It contains five 400-hp, 3100-volt three-phase generators, which are partly driven by steam engines, and partly by direct-current motors. The arrangement of the station which is very spacious, and especially of the instruments, switches, etc., is described in detail.—*Elek. Zeit.*, Oct. 3.

ELECTRO-PHYSICS AND MAGNETISM.

Interference and Polarization of Electric Waves.—QUINCKE.—An abstract of a Brit. Ass'n Adv. Sc. paper, in which he describes some apparatus for producing plane polarized Hertzian radiation of definite wave-length, and for causing two waves, one displaced a quarter length behind the other, to interfere. An ordinary oscillator is placed at the mouth of a metal tube leading into a square metal box from which two branch tubes curve round to a similar box containing the coherer. This apparatus always gives waves of the same wave-length, whatever may be the nature of the oscillator and whatever the fluid or other substance filling the tubes. He found that the ratio of the velocities of the waves in the tubes to the waves outside, was as four to three in the apparatus which he used. In another form of the apparatus the radiation from the oscillator is passed through a straight tube to the coherer, but midway along this tube there is a T-piece consisting of a vertical tube which may be either closed or open. By adjusting the length of this T-piece the reflected wave from the bottom of it may be made to interfere exactly with the wave passing straight through. These apparatus closely resemble the acoustical apparatus for producing similar phenomena with sound. In the discussion, Larmor suggested that the wave-length was determined by the tubular apparatus, and not by the actual oscillator, the tubes picking out the particular oscillation corresponding to their own natural period of oscillation. Quincke agreed with this.—Lond.*Elec.*, Sept. 20.

Conduction of Electricity Through Mercury Vapor.—SCHUSTER.—A brief abstract of a paper read before the Brit. Ass'n Adv. Sc. He first described the extreme difficulty in obtaining perfectly pure mercury vapor, free from oxygen or other gas. Using "the voltage of about 1000 cells" between the surfaces of the mercury over which the vapor was formed, he found that the discharge commenced at about 100 degs. C., and as the purity increased the temperature at which discharge took place rose to 130 or 160 degs. Even at atmospheric pressure, with the vapor at this temperature a strong discharge was obtainable from 1000 cells, and in every case the much-debated dark space was clearly in evidence. The sparks appeared to spring from the line of contact between the mercury surface and the glass. In the discussion, Lord Kelvin described this as "a very upsetting paper," as from Schuster's experiments it would follow that the mean free path of the mercury molecules might be as much as 2 or 3 cm. in length, even at atmospheric pressure, within the dark space. Schuster replied that he believed that the mean free path has nothing to do with the existence of the dark space.—Lond. *Elec.*, Sept. 20.

Nature of Lighting.—KOCH.—He has found that lightning conductors whose connections have become imperfect through rusting or otherwise, act, nevertheless, in quite an efficient manner in the case of a thunderstorm. This is, in his opinion, due to the oscillating character of lightning discharges. Electromagnetic waves are produced, which act upon the imperfect connection as upon a coherer, restoring their conductivity for a more or less long period.—*Phys. Zeit.*, Sept. 14; abstracted in Lond. *Elec.*, Sept. 27.

Ions in the Atmosphere.—EBERT.—Since the researches of Elster and Geitel have made it appear certain that free positive and negative ions exist in the atmosphere, the present author has attempted to arrive at a quantitative estimation of their number under different atmospheric conditions. The results show that the number of free ions is very much larger in clear sunny weather than in air filled with dust or moisture. The number is small in any case. The free charges in 1 cubic meter amount to about 1 electrostatic unit. The amount of ionization is about the 100,000th part of that produced by feeble Röntgen rays.—*Phys. Zeit.*, Aug. 17; abstracted in Lond. *Elec.*, Sept. 27.

Preservation of Standard Magnets.—KLEMENCIC.—Since the discovery of new magnetic steels, it is possible to make permanent magnets which keep a constant moment for a whole year within 0.1 per cent. The question as to the best means of storing them when not in use is answered as follows: He encloses the magnet in a glass tube filled with cotton wool, which, in its turn, is embedded in an iron box with sides 3 mm. in thickness. This prevents both disturbances by jarring and by an external magnetic field.—Lond. *Elec.*, Sept. 27.

Magnetic Properties of Iron.—MAUERMANN.—A long communication giving an account of experiments, in which he studied the influence of annealing upon the magnetic properties of iron. The values of hysteresis obtained show the great influence of the temperature used, the duration of the annealing and the thickness of the sheets. With a temperature of 700 to 750 degs. the best results were obtained by annealing for 18 hours for sheets of 0.7 mm. thickness, 24 hours for 0.5 mm. thickness, and 9 hours for 0.3 mm. thickness. To anneal for a longer time is disadvantageous. The longer hours for the 0.5 mm. thickness seems to be accidental. Experiments with a higher temperature, 950 to 1000 degs. C., showed that this is disadvantageous, especially for sheets of 0.7 mm. thickness. The fact often observed that the rim of iron sheets for dynamos is worse than the middle part, is probably due to the circumstance that the rim was heated to too high a temperature. The ageing of iron sheets is also intimately connected with the temperature used in annealing. The ageing was found to be due to the ues of too high a temperature in annealing.—*Elek. Zeit.*, Oct. 10.

REFERENCES.

Poynting's Theorem.—FRANKLIN.—A mathematical paper on "Poynting's theorem and the distribution of electric field inside and outside of a conductor carrying electric current." After some general remarks on Poynting's theorem, he deals in detail with the following examples, illustrating this theorem: The slow discharge of two parallel charged cylindrical conductors through a cylindrical current sheet; current in a cylindrical sheet, nearly closed; electric current in two parallel infinite conducting sheets; flow of energy around a metal shield placed near a current sheet. All these examples apply to two dimensions only.—*Phys. Rev.*, Sept.

Induced Radio-Activity.—MAX LENNAN.—He has found some further cases of the induction of a secondary radio-activity by the action of cathode rays. The sulphates and sulphides of calcium, strontium and barium, show a distinct induced radio-activity on heating slightly after exposure.—*Phys. Zeit.*, Sept. 7; abstracted in Lond. *Elec.*, Sept. 27.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrolysis of Fused Alkali Chlorides.—FISCHER.—A note on his experiments in which he has studied the causes of the fact that the sodium yield in the electrolysis of fused sodium chloride decreases as the temperature rises. He finds that the sodium loss is due to stray convection current, which can be avoided by the following arrangement. The two electrodes are arranged horizontally in alignment in an iron box, across which a cooling trough of marble is placed, dipping a little into the mass and cooling, but not freezing it. The anode is a carbon rod, the cathode a hollow iron pipe, through which the sodium which floats on the salt flows off. The arrangement entirely obviates the detrimental convection currents and consequent losses of sodium. But as the sodium spreads on the surface, the current density diminishes, and with it the heating effect of the current. As a result, the fused salt becomes sluggish, and the electrolysis is more and more limited to the neighborhood of the anode. A quick removal of the sodium, desirable in every respect, has, therefore, to be provided for.—Lond. *Eng'ing*, Oct. 4.

U. S. Electro-Chemical Industry.—J. B. C. KERSHAW.—The first article of a serial on the electro-chemical and electro-metallurgical industry, dealing with the progress in the United States. The United States output of raw copper in 1900 was 268,000 tons. There exist in the United States eight electrolytic copper refineries, with an aggregate capacity of refining 211,000 tons per year. The United States aluminum output in 1900 was 3190 tons, 10,000 horse-power being available for this manufacture at Niagara. By the end of this year it is probable that 7700 horse-power, all generated from water, will

be utilized in the United States for alkali and chlorine manufacture. A few brief remarks are added on the production of calcium carbide, chlorate of potash and soda and nickel—*Elec. Rev.*, Oct. 12.

Orlyte.—DUSCHAU DE VULITCH.—An account of experiments made by Orlowski on a method of reducing the excessive hygroscopic properties of carbide of calcium. He has discovered a new material "orlyte" in the following way: The pasty mass of carbide, as it issues from the furnace, is dropped into "a mixture of natural tar and mazout or astatki, the proportions and application of which are protected by a patent." This lasts about a minute, during which the carbide absorbs 4 per cent of impregnating material. A yield of 300 to 310 liters of acetylene per kilogram and a lighter and more perfect flame are claimed. Orlyte is not hygroscopic, the greasy material it contains being unaffected by moisture.—*Jour. de l'Elec.*, No. 125; abstracted in *The Elec. Chem. and Met.*, Sept.

Edison Storage Battery.—An illustrated translation of a new Brit. patent by Edison for his battery (May 21, 1901). In an editorial note it is claimed that the methods described in the patent for preparing the ferrous oxide and for the conversion of a lower oxide of nickel to higher ones by means of chlorine are not new. The exact description of the mechanical manufacture of the plates is new.—*Centralblatt f. Accum.*, Oct. 1.

NEUBURGER.—An article on the Edison storage battery and its value for automobilism. The main criticisms made are that long life of the cell has not yet been proven, that he cell requires more space than the lead cell, and that it is more expensive.—*Der Motorwagen*, v. 4, p. 190, 204; abstracted in *Centralblatt f. Accum.*, Oct. 1.

Color of Ions.—VAILLANT.—A French Acad. note in which he shows that in a completely dissociated solution containing only one colored ion, the color is independent of the nature of the other ion. If, on the contrary, the ionization is not complete, the coloration varies with the concentration and with the nature of the colorless ion. The coloration of a solution of whatever possible concentration can be, as a rule, connected with a value of its degree of concentration by a formula containing two, and only two constants, which relatively characterize the complete molecule and the dissociated molecule.—*Comptes Rendus*, Aug. 12; translated in *The Elec. Chem. and Met.*, Sept.

Electrolytic Piperidin.—A note on the production of the valuable stimulant piperidin by the reduction of pyridin in acid solutions. The best conditions for the electrolytic reduction are given by Pip as follows: "The sulphuric acid must be pure, and must be present in the proportion of at least 3 parts to 1 of pyridin. The electrodes may be of lead, silver, mercury or carbon, but not of platinum. The diaphragm must be free from all traces of salts of metals other than the above." A German firm is said to be about to work the process on a commercial scale.—*The Elec. Chem. and Met.*, Sept.

REFERENCES.

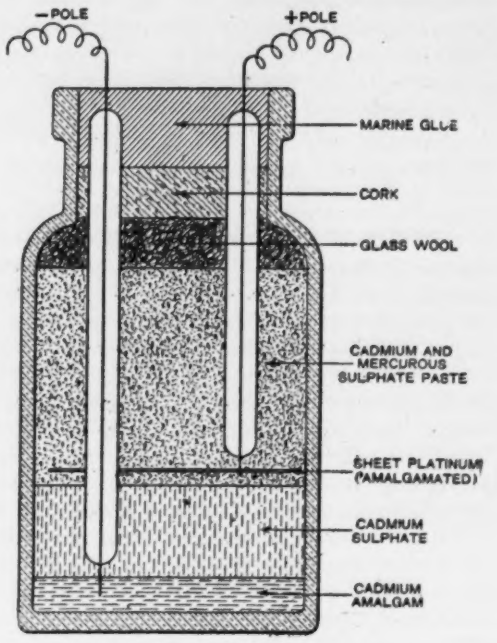
Acker Alkali Process.—ACKER.—An illustrated description of his process for producing caustic alkalies from fused electrolytes.—*Elektrochem. Zeit.*, Oct.

Electrolysis of Fused Salts.—GARRARD.—An illustrated article in which he gives a longer account of Lorenz's paper, abstracted at some length in the Digest, Aug. 10.—*The Elec. Chem. and Met.*, Sept.

AUERBACH.—An account of an experimental investigation of the electrolysis of fused iodide of lead and chloride of lead.—*Zeit. f. Anory Chem.*, v. 28, p. 1; abstracted in *The Elec. Chem. and Met.*, Sept.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Cadmium Standard Cell.—TINSLEY.—A description of a cadmium standard cell, in which he has tried to follow out the ideas advanced by Callendar as to the elimination of the errors due to diffusion lag in the zinc sulphate solution. He, moreover, aimed at obtaining a cell which would bear a perceptible current being taken from it without polarizing, and which would bear a short circuit with a certainty of almost immediate recovery without artificial means. The construction of the cell is shown in the adjoining diagram. Very little free moisture is present. Six cells made on different dates and with chemicals from two different makers, have a voltage varying between 1.0192 and 1.0190. He attributes this closeness in value to be partly due to the method of using only platinum wire for connections, as soldering usually causes a slight local action, especially if any trace of chemical happens to get on the joint. The curve of a discharge of the cell through 520 ohms is reproduced. At the start the internal resistance was about 40 ohms, and the current obtained was 1.8 milliamperes. In the first four hours the voltage dropped to 0.38, and the current to 1.6 milliamperes. In the next hour the voltage dropped quickly to 0.5, the voltage curve showing a sharp bend. This he thinks to be due to the electrode becoming completely covered with hydrogen. At this point the cell appears to become incapable of maintaining a current of any useful value. When once a cell has been allowed to discharge to a point beyond this sharp bend, it is some-



SECTION OF CADMIUM CELL, FULL SIZE.

what difficult for it to regain its normal, healthy condition unless a large amount of liquid is present in the cell. But a standard cell is scarcely subjected to such treatment. This form of cell should be very useful where a small current of, say, about 1 milliampere is required for short periods. The most serious drawback is the liability of the cadmium amalgam to dissociate when subjected to heavy jars. —Lond. *Elec.*, Oct. 18.

Turbine Interrupter.—An illustrated description of an interrupter, devised by Lecarme Brothers & Mitchel for the operation of Ruhmkorff coils from ordinary lighting circuits of about 100 to 120 volts. The contact is made and broken between brass and copper. To avoid the disadvantages of high-current density at the point of contact, the contact pieces have a large surface. The movable part is an axle on which four paddles are mounted with elongations of flexible and elastic brass; the current is supplied to the axle by means of a brush and slip-ring. This movable part is driven by an electric motor and revolves in a bronze case, which, however, is isolated from the movable part. The bronze case is filled with petroleum, and on its inner sides four pieces of copper are fixed which bear copper brushes to make contact with the four rotating brass paddles. The current leaves the interrupter through the brass case. When the movable part makes one revolution, the current is interrupted four times. It is claimed that the wear and tear of the brushes and paddles is small, and that the temperature does not rise above a suitable limit.—*Cosmos*, Oct. 5.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telephone Cables.—WEST.—Calculation shows that the electrostatic capacity of telephone cables is greater with wires laid up in separate pairs than laid up in fours. But cables with wires laid up in fours show the bad effects of mutual induction, such as cross-talk. There should be no mutual induction, if in any cross-section of the cable the arrangement of the four wires and of the copper cores in their insulating covers would be entirely symmetrical, but this is only the case as long as the bundle is not stranded. The process of stranding draws the wires inwards towards the axle of the bundle and round the axle in the direction of stranding. Moreover, in practice some of the bobbins of the stranding machine have a tighter strain on them than others. This disturbs the symmetry of the arrange-

ment of the four wires, hence the mutual induction. He, therefore, suggests mounting the bobbins so that they rotate very easily and then to apply to each an accurately graded brake, but this would only lessen the trouble. He hopes for better results from other remedies, either by means of balancing the cable when the different sections are joined together, or by changing the direction of the winding alternately at intervals. He thinks such arrangements would pay on interurban lines, as they decrease the capacity.—*Elek. Zeit.*, Oct. 3; Lond. *Elec.*, Oct. 11.

Some editorial notes on this article. The starting point of West is denied. It is said that in practice the capacity of the cable for the same number and size of conductors and thickness of insulation is slightly greater instead of slightly less for a cable laid up in fours than one laid up in pairs. But the cost of the former is less, and this speaks in its favor. West's explanation of the reason of the cross-talk is thought to be correct, but it is said that his remedies can hardly be relied on sufficiently to eliminate the fault which is inherent in cables laid up in fours. The conclusion is, therefore, reached that the saving in using this class of cable instead of paired cable is not worth the extra precaution and risks of failure.—Lond. *Elec.*, Oct. 11.

REFERENCES.

Glasgow.—An illustrated description of the Glasgow municipal telephone exchange which is constructed on "the call-wire method," and is laid out to accommodate 10,000 subscribers.—Lond. *Lightning*, Oct. 3.

Block Signals.—PRASCH.—An illustrated paper on the block signal system of Krizik.—*Zeit. Oest. Ing. u. Arch. Ver.*, Sept. 27, Oct. 4.

Railway Signaling.—TIMMIS.—His Glasgow Congress paper in full, with many illustrations, describing and discussing modern pneumatic and electric systems of railway signaling; an abstract of which was recently noticed in the Digest.—Lond. *Eng'ing*, Oct. 11.

Second Annual New York Automobile Show.

The second annual automobile show, given in New York City under the auspices of the Automobile Club of America, was held during the present week and will continue until Saturday night. When it opened last Saturday, preparations were a little backward, but early this week everything was in readiness for the attention of the large crowds which have flocked to Madison Square Garden each day. In some respects the show is different from that of last year, there being no track. A great deal of animation, pleasure and interest was contributed last year by the fine board track which encircled the exhibits on the main floor, upon which various types of vehicles sped around, showing their paces, but in view of the obvious dangers from fire due to the presence of gasoline and the chances of collision, explosion and panic, the officers of the club felt themselves reluctantly but imperatively compelled to dispense with the track feature. In fact, gasoline is practically excluded from the Garden, vehicles being required to discharge their supply before entering. Another feature of great interest missing this year is the sensational grade on the roof garden, where a fine display was made of hill climbing ability. A third element of special interest that has not been repeated are the various tests on the track, as to ease of starting, stopping, avoiding obstacles, etc. The absence of these features would appear to have lessened the attendance somewhat, although it is difficult to judge of that off-hand, as the public has had more room for circulation, while at the same time such exhibition space as was rendered available was taken up by exhibitors, of whom there are over a hundred. The quality of the attendance has been beyond dispute, and the number of sales reported, even of the costliest machines, is quite large. Toward the end of the week the number of "sold" signs appearing on handsome vehicles, with the names of the purchasers, was very noteworthy. One of the moot points among amateurs and manufacturers during the week was that of the best time to give the show. The idea of the club has been that it was a good plan to hold the show at this season of the year, just ahead of the Horse Show, but not a few favor and prefer a spring exhibition. They say that the public finds it hard to reconcile new styles with the approach of winter, and regards the vehicles as, for example, the "1901 model," whereas they are slow to believe that they are in reality being shown the "1902 model." Of course, it would hardly be advisable to hold another club show in the spring of next year, but should the advocates of a change of date prevail, the third show might not take place until the spring of 1903, which seems a long, long way off when dealing with anything so young and progressive as the automobile industry in America.

On entering the Garden, the visitor finds the whole restaurant occupied by the loan exhibit of the club, and a most interesting department it is, inclusive as it is of the vehicles actually owned and used by the members, well-known men of wealth and sporting proclivities, who have taken up with zest and enthusiasm the new amusement. A number of fine, though ponderous, machines are thus shown, in few of which are there any traces of beauty or any attempt at graceful curves, but it seems too much to expect just yet successful attempts at æsthetic effect in vehicles of 20 or 30 horse-power, built for touring over rough, dusty roads or for "hitting it up" to a mile a minute on the race track. One of the neatest machines here is that loaned by Mr. A. L. McMurtry, a 12-hp gasoline, weighing 2100 pounds, built by the Ohio Automobile Company, in which the Packards, so well known in the electrical field, are prominent and have decidedly added to their mechanical and engineering reputation. Mr. Jefferson Seligman, the treasurer of the club, and well known also in electrical circles, has a handsome De Dion-Bouton machine of five horse-power there, and Mr. Spencer Trask shows his fine "Searchmont" of six horse-power. But of chief interest to electrical people visiting the show, as well as to a curious throng always grouped around the most little table on which it stands, is the complete cell of the new type Edison iron-nickel storage battery. Not only is the working cell shown assembled, but the parts are also exhibited in full detail. The cell is 12 inches hight, 2 inches thick, 5 inches wide and weighs 7½ pounds. It gives 120 watt hours, or 46 pounds per horse-power hour. The cell is a loan exhibit, but during the week Mr. J. M. Hill, an active member of the club and now associated with the new Edison battery company, has been in frequent attendance, while Mr. John Ott, of the Edison laboratory, has likewise given some of his time to answering the innumerable inquries to which the unpretentious exhibit gives rise.

On entering the main floor, it is found profusely decorated, while the exhibits follow the customary grouping along two main aisles, cross aisles and the circular aisle flanked by exhibits against the balcony wall, the balcony over the boxes being also fully occupied. In addition, the club has had a headquarters at the Garden during the week in one of the parlors, and the National Association of Automobile Manufacturers has also been in session during the week, closing its convention with a supper at the Hoffman House on Thursday night. Notes are given below as to some of the exhibits of electrical interest.

THE ELECTRIC VEHICLE COMPANY, which had a large space at the main entrance, exhibited two distinct novelties in the way of light electric runabouts. Their "town and country" runabout, finished in black, with seat panels, shutters and running-gear in red, hubs of

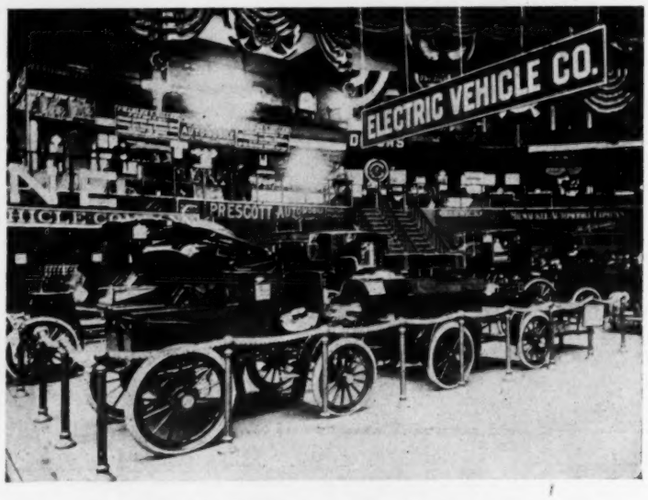


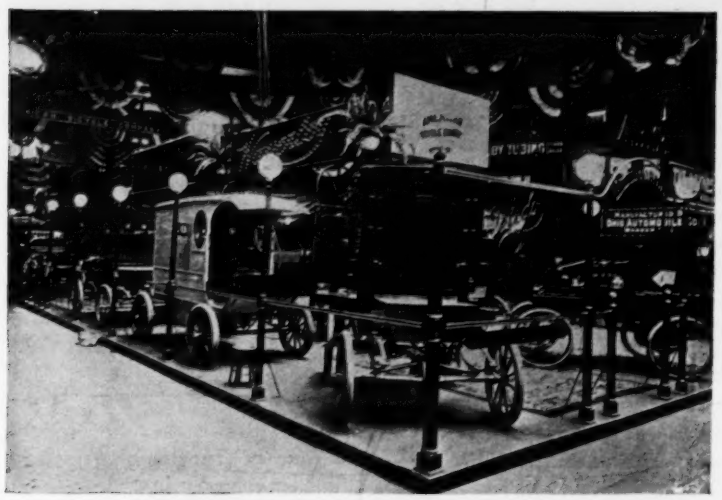
EXHIBIT OF ELECTRIC VEHICLE COMPANY.

nickel and with trimmings in black leather, is one of the lightest electric vehicles ever built. The carriage weighs only 875 pounds, equipped with the new Exide battery, consisting of 40 cells, which give it a touring radius of 40 miles on one charge, at a maximum speed of 14 miles per hour. The "Seabright Runabout," finished in

black, with seat panels and shutters in red, and red running-gear, weighing 1,675 pounds, is a heavier machine of the "town and country" type. In addition to these new models, the company had its usual line of standard types, which recently won a gold medal at the Pan-American Exposition and received commendation for tasteful excellence and beauty at many important automobile shows of the past year. The company was represented during the week by Messrs. Dodge, Riker, Byllesby, Condict, Cox, Armstrong, Jones, Scott, Edwards and McGee.

GENERAL POWER COMPANY, 100 William Street, New York, had an interesting exhibit in the balcony, illustrative of the ease and economy with which its kerosene engines of the new Secor type can be applied to the generation of current for automobile purposes. It still remains a question with many owners of vehicles how they shall procure the necessary current, and the compact little units shown by the company would indicate that there is no trouble in using the kerosene at the stable, with all its defects of odor, etc., and getting all the benefits of electricity for propulsion. The exhibit, which had a sign run from the unit, was the centre of much attention. It was stated that a 2½-hp engine was feeding 40 lamps of 10 candle-power. There was a brilliant searchlight run from the same outfit.

THE AMERICAN BICYCLE COMPANY had a large and fine exhibit at the eastern end of the main floor, heralded by three huge electric signs. For electrical people the chief interest here lay in the excellent Waverley electric automobiles and the Sperry battery. No fewer than six Waverleys were shown, including their Stanhopes, with and without top, a surrey and a delivery wagon. The surrey is a roomy, two-seated vehicle, and likely to be not less popular than the



WAVERLEY ELECTRIC AUTOMOBILES.

runabouts of the same make. In the space were two tables upon which were spread parts used in the construction of these carriages. The features of the Sperry battery, to which much attention has of late been given in these pages, were also the subject of considerable attention and inquiry during the week. Two other divisions of the space were similarly occupied, one being devoted to Toledo steam automobiles and the other to gasolines, one of which finished the Buffalo run without any repairs during its trip. The motive power is furnished by a double-cylinder upright hydrocarbon engine of seven horse-power, using ordinary store gasoline. A number of officials and representatives of the company were in constant attendance, including Messrs. E. A. Sperry and R. H. Hassler, for the electrical end, and Messrs. E. O. Durfee and O. B. Henderson, of the automobile department of the company. Messrs. Coleman, Merseles and Schaaf, of the executive staff, were also present.

NEW PROCESS RAWHIDE COMPANY, of Syracuse, N. Y., had a very neat exhibit in the balcony, in charge of young Mr. T. G. Meachem, who showed an interesting collection of their rawhide pinions, which, in addition to being in use on over 200 electric railways, are already to be found very generally on the modern automobile. Mr. Meachem had a small electric motor carrying on its armature shaft two pinions, one of rawhide and one of steel, so arranged that either could be thrown into mesh with a steel gear wheel. The contrast between the noiselessness of the one combination and the racket made by the other left no room for argument.

THE PORTER BATTERY COMPANY, of the Monadnock Block, Chicago, had a nice exhibit in the balcony, in charge of Mr. A. S. Moses, who made the welcome announcement that the concern is about to open New York offices. It will be remembered that the remarkable tests lately made with this storage battery in Chicago and Cleveland were lately described for us by Mr. F. C. Philips, of the Elwell-Parker Company. The exhibit embraced parts of the battery, including the "grids," showing the peculiar formation of the cup-like slats to hold the active material, positive plates, negative plates and complete cells, of which five were shown mounted in a box. The special lugs used on the plates, making an excellent solid joint, were also shown. The literature distributed by the company included a neat pamphlet showing curves, and a report of Professors Woodworth and Hatch, of the Lewis Institute of Chicago, on an automobile test.

SEARCHMONT MOTOR COMPANY, of Philadelphia, now controlled, it is understood, by Mr. John Wanamaker, had an excellent display of their hydro-carbon vehicles, being represented by Mr. W. E. Hazelton, for a long time active in the electrical field, and who now has charge also of the interesting Wanamaker automobile station in 57th Street.

WARD LEONARD ELECTRIC COMPANY, of Bronxville, N. Y., had an exhibit of the excellent gasoline vehicle designed by Mr. H. Ward Leonard and lately shown and described in these pages.

BAKER MOTOR VEHICLE COMPANY, of Cleveland, showed four electric vehicles—runabouts and Stanhopes—of the type already illus-

BAKER MOTOR VEHICLES.

trated in these pages. There is virtually no change in these handy little vehicles, but the Stanhopes are an addition to the line, especially adapted for driving by ladies.

VEHICLE EQUIPMENT COMPANY, of Brooklyn, had up in the southeast corner of the Garden a very striking exhibit in the safe truck devised by them for the Hall Safe Company. In addition to being an electric automobile, the truck is equipped with hoisting gear operated by a small General Electric motor, and it was shown at the Garden elevating and raising a good-sized office safe. The exhibit by Mr. Gibbs included also an ordinary ambulance and a special vehicle built to order for one of the lying-in hospitals of Greater New York.

THE HYDRA DOUBLE BATTERY COMPANY, of 32 Broadway, New York, Mr. W. J. Hart in charge, had an interesting exhibit of their "Hydra" semi-dry battery for ignition purposes in hydro-carbon vehicles, and the usual uses to which batteries of this type are put. It is stated that the battery contains a large sealed carbon inner "storage" cell, filled with a special electrolyte, in which is carried a second zinc cylinder, greatly increasing the active surface. Mr. Hart interested the electricians present by showing the battery working on an ignition plug surrounded by a glass tube about 2 inches long by 1 inch diameter, to which air was pumped, the brightness of the spark when the air was pumped in being unusually bright for the time.

MR. C. E. MILLER, of 97 Reade Street, New York City, had an admirable collection of automobile supplies and specialties, among which may be noted the Pignolet pocket voltmeters and ammeters. The volt-ammeters are used for ascertaining the condition of dry

batteries used for ignition in gasoline vehicles, to show if new batteries are of full strength and when old ones should be renewed, as well as for testing circuits, locating grounds, short circuits and other trouble. There were also low-reading Pignolet voltmeters for testing single cells of storage battery. These instruments are of sufficient size to give readings of considerable range and at the same time are small enough to be carried in the pocket if desired.

DESBERON MOTOR CAR COMPANY, of 51st Street and 12th Avenue, New York, had an interesting exhibit, in charge of Mr. E. T. Birdsall, the well-known electrical engineer, who also exhibited a new and effective form of ignition plug.

The "Flexduct" Flexible Conduit for Wiring.

One of the most interesting and important fields of modern electrical development is that of the conduit, and within a comparatively few years the art of interior wiring has been improved out of all knowledge, while a great new industry, that of conduit manufacture, has been added to the resources of electrical application. The gain in safety due to the conduit, as well as the greater beauty and invisibility of wiring work; the greater accessibility of the conductors for inspection; the possibility of providing for extensions and increases; and the facilities afforded for laying out a scientific network of protected circuits under all conditions of interior wiring—these and other features have given the conduit a deservedly high position of late years, so that no really good and first-class installation is now undertaken without its aid.

When it comes to the type of conduit that shall be used, opinions have differed widely, from the extremes of rigidity to those of flexibility, and the subject has received the careful thought of some of the best minds engaged in electrical engineering. The new conduit illustrated herewith is of the flexible type, to which the name "Flexduct" has been given, and its advent has been noted with much interest in the trade and profession. Its basic material is woven fibre, and the general construction can be inferred from Figs. 1 and 2, which show the outer covering, the inner tube and a section of the tube split open to exhibit the interior. The tube is closely woven, and inseparable or integral. The strands of the warp pass over and under the spiral alternately, and the weaving runs longitudinally, so that a smooth and unresisting surface is presented on the inside. The warp forms the inner lining and parallels the tube. It will be evident, therefore, that the spiral cannot be unwound and that the interior cannot be ripped out, the whole constituting practically one member. The smoothness of the channel insures anyhow freedom from any such catching

FIG. 1.—FLEXIBLE CONDUIT.

or ripping, and a peculiarly notable combination is secured of the qualities of toughness, smoothness and flexibility. After the conduit has been woven and built up, it is treated with a special compound which fills up and saturates thoroughly the whole fabric, rendering it absolutely proof against moisture, which is one of the most insidious foes that beset conduits. It is stated that not depending upon mere

FIG. 2.—FLEXIBLE CONDUIT.

adhesiveness in construction, but essentially upon its interweaving, it never "dries out," but remains always supple and yet tough.

The "Flexduct" conduit is made by the Osburn Flexible Conduit Company, which has opened offices for New York at 21 Park Row. The company has constructed a factory at Hoboken, N. J., of adequate capacity to fill a large demand, and equipped with a special plant for the production of the conduit. Mr. W. H. Seaich is president; Mr. C. E. Corrigan, vice-president; Mr. F. B. Thomas, general manager of the Waldorf, treasurer; and Mr. Harry G. Osburn, secretary. The conduit is made under the patents of Mr. Osburn, who is already well known for his storage battery and other inventions. The conduit is being made in all the sizes from ¼ inch up to 2 inches.

Motors in the Printing Office.

The Triumph Electric Company, of Cincinnati, Ohio, has lately brought out a number of special motor applications, as noted in these pages last week. We now illustrate two of these pertaining to the

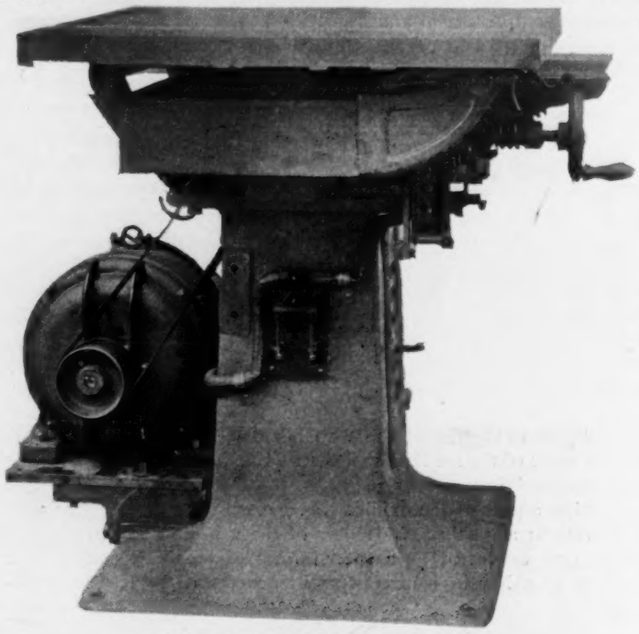


FIG. 1.—ELECTRICALLY DRIVEN PLANER.

printing office. One of the motor-driven tools shown is a jig saw used in printing offices for the purpose of sawing up lead plates. The other tool is a small planer also used in the same class of establishment for planing the edges of the lead plates so as to fit them for the form. In both cases standard-speed Triumph motors are

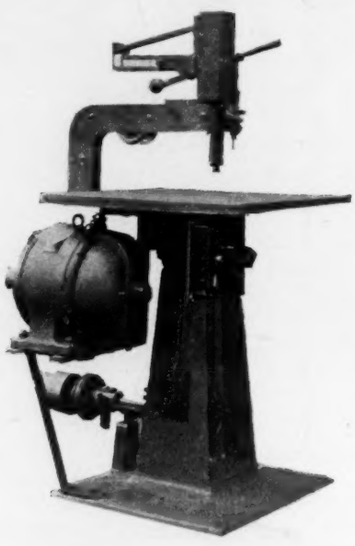


FIG. 2.—ELECTRICALLY DRIVEN JIG SAW.

used, the motors being placed on brackets fastened to the tools and short belted between the shaft of the motor and the shaft of the tools. In this manner floor space is not occupied, and the motor is associated very closely and economically with the work that it has to do. It will be noted that in each case a standard, rather than a special, motor has been found better and cheaper for this work.

Universal Sign Receptacles.

The Brewster universal sign receptacles and appliances, manufactured by the Electric Motor & Equipment Company, Newark, N. J., constitute a system of units from which may be quickly formed, wired and installed anything in the shape of electric signs or electric decorations. The appliances are weather-proof and are particularly adapted for outdoor use.

The illustration shown below exhibits the method of connecting and hanging the receptacles. Any one owning an equipment of these receptacles and the connecting clamp hooks possesses a ready means of effective advertising by the use of electric light. There is no limit to form or extent, and the sign or decoration of to-day can be changed to something different to-morrow with trifling labor. These receptacles were shown at the meeting of the New York Electrical Society, on Oct. 30, and were commended by the lecturer of the evening.

The S. K. C. System at the Pan-American.

ONE of the largest and best exhibits in Electricity Building at the Pan-American Exposition was that of the Stanley Electric Manufacturing Company, which is illustrated on this page. Its chief features were a relief map of the Standard Company's transmission lines in California; a 60,000-volt combination switch and fuse; a standard S. K. C. frequency changer in operation in the service of the Exposition Company, and a 300-kw, two-phase standard S. K. C. inductor, with separate phase-regulating device in operation in the Exposition power house. The performance of this machine was very gratifying to the Exposition authorities, and especially so to the power house attendants. This machine supplied current to all of the arc lamps on the Midway, and did part of the incandescent lighting.

Forming a part of the exhibit was a small motor-generator outfit in operation; a synchronous motor of the well-known S. K. C. inductor type connected by a special form of flexible insulated link coupling to a Northern direct-current generator, the latter occupying a position in the Northern Electrical Manufacturing Company's exhibit, which adjoined that of the Stanley Company. This motor generator outfit was brought up to speed by a direct-current back-geared motor.

Included in the S. K. C. exhibit were the following: A fuse slide oil switch, the latest development in ordinary tension c switches. The switch was shown arranged for 2400 volts and approximately 250 amperes. It is made in all sizes up to 10,000 volts. It is a two-pole, single-throw switch. The special features of design are simplicity of mechanism, and a special long break between terminals and blade supplying an ample factor of safety. As is usual with S. K. C. apparatus, small details are carefully looked after, and proportions are liberal and robust. The switch is thoroughly insulated from the front of the board protecting the operator, and its design permits of installation to suit a variety of conditions. Although the break is in oil, zinc tips are provided to take the slight pitting on the blades which is inevitable, and which in time make a bad contact. The zinc tips are readily removable. The tank is porcelain lined, providing additional insulation, and is self-contained, and by taking out four machine screws is easily removable, exposing the mechanism of the switch. The terminals on top of the switch are provided with wooden boxes protecting against improper contacts.

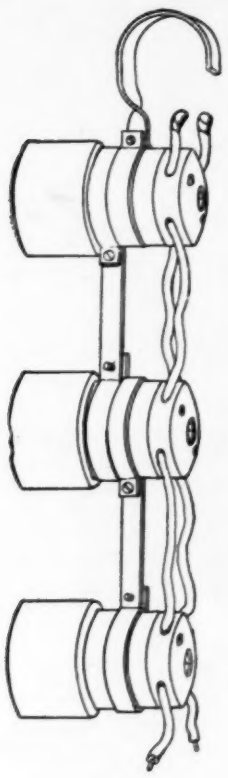
Among the transformers on exhibition were the type T, oil insulated and self-cooling, used by the great power transmission companies in California, some of which transform to and from 60,000 volts. Another was the S. K. C. subway, oil insulated, self-cooling transformer, designed particularly for installation in subway manholes. The extreme diameter of all sizes of this transformer is the same, viz., 24 inches, so that it can be passed readily through the opening of a standard manhole, the length increasing with the capacity. This type of transformer can be safely operated when entirely submerged in water. Being used for incandescent lighting particularly, they are built with very close regulation without sacrificing efficiency, and with low temperature rise. A special junction box was also shown for use where it is desired to run several secondary circuits from a single transformer.

The S. K. C. type A. O. (oil insulated) lighting transformer shown, is the latest transformer placed on the market by the Stanley Company. It is built in 15 sizes, from ½ to 30 kilowatts capacity.

Special attention was called to the device of Mr. John F. Kelly, which is used in all Stanley transformers, a magnetic iron core having in its composition an alloy preventing hysteresis growth. The object is the prevention of increase in core loss.

A complete line of their hot-wire measuring instruments and of dynamometers, wattmeters and power factor indicators, static voltmeters and static ground detectors were shown very effectively arranged, and hot-wire ammeters and voltmeters were also on view in both switchboard and portable types.

Reference has already been made to the 60,000-volt combination switch and fuse, and a detail description of this very interesting device is given in ELECTRICAL WORLD AND ENGINEER of June 29, 1901. Many hundred of these switches are in use in California at the present time, and they are doubtless the highest voltage switches in practical operation. One of them occupied a prominent position in the Stanley exhibit. Next to the 60,000-volt switch and extending



SIGN RECEPTACLES.

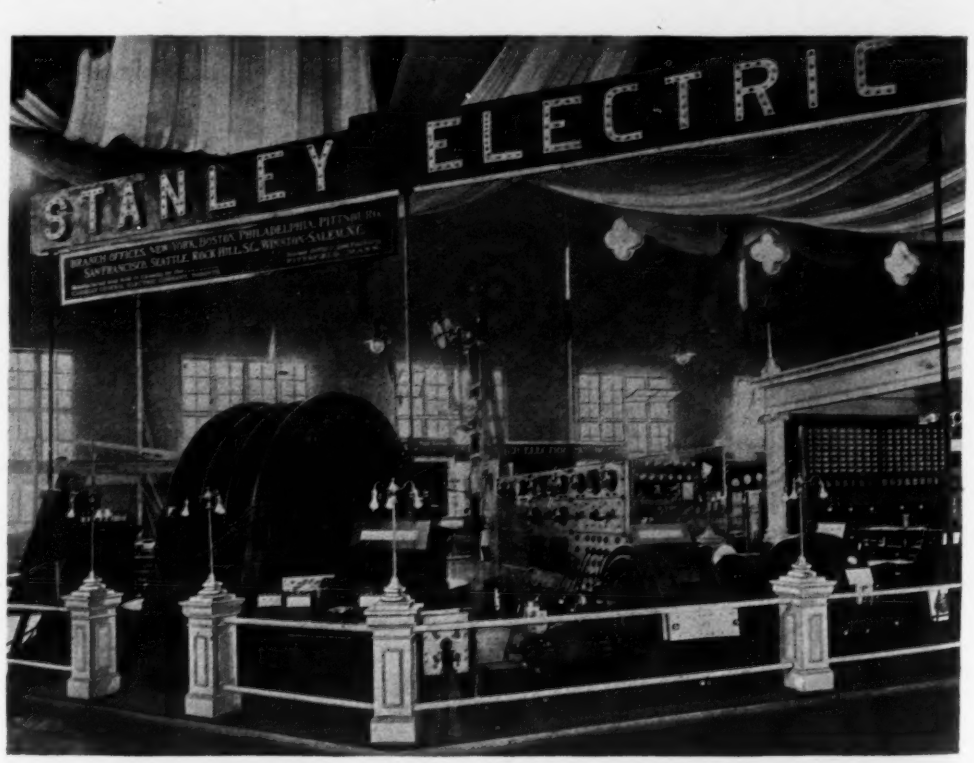


EXHIBIT OF THE S. K. C. SYSTEM.

practically the whole width of the exhibit was the standard S. K. C. switchboard, of marble, mounted on a steel frame. The exciter panel of this board is designed for single and multiple running of two exciters. The generator panel is designed for the control of a standard two-phase generator and provided with two three-pole switches and separate phase-regulation apparatus.

The complete line of S. K. C. switchboard instruments were shown mounted on the switchboard. The circuit panel was arranged for separate circuit regulation and for control of two circuits. Thereon were also mounted standard S. K. C. plugs and cables. This arrangement of plugs and cables allows any circuit to be plugged upon any phase of two two-phase machines. On the larger outfits the installation can be made to provide any combination. Another panel contained exclusively fusible cut-outs, and all of their well-known types. The well-known ball fuse was also shown in a variety of sizes. This fuse is so constructed that when the fuse proper blows carbon balls are blown into cavities arranged as receptacles, and the arc is effectively ruptured. Thirty thousand volts, with large capacity behind it, has been repeatedly short circuited through this device without a failure.

The lightning arrester exhibit was a particularly interesting one, and included the well-known cylindrical lightning arrester, standard S. K. C. choke coils and line dischargers. One of the most unique and striking figures of this exhibit was the use of the condensers connected in multiple with the field of the alternating-current motors, making a motor take current in proportion to its load, substantially as direct-current motors do. When so placed they supply the lagging combination of the current, or, in other words, the false current. With this arrangement the false current instead of flowing back through the transformer line and generator, thereby disturbing the whole system, simply flows to a local circuit through the condensers.

A new form of combined slide switch and circuit breaker was shown. This is a novel device and is virtually the simple addition of the circuit breaker attachment to the standard S. K. C. slide switch. When used as a switch the circuit breaker is not acted upon. Therefore the attendant does not have to close the switch against a spring. When the combination is closed, any overload immediately operates the circuit-breaker attachment, the combination acting as a circuit breaker. It is obvious that the one apparatus performs the functions which usually require two. This is especially desirable for crowded switchboards and is itself installed in small compass. Naturally the pecuniary saving is considerable. A double-pole, double-throw combination is made in the same form. Many makes of switches require twice the amount of room for double-throw as for single-throw. The device shown takes up no more room double than single.

A Pan-American Switchboard.

One of the switchboards exhibited at the Pan-American Exposition and in constant service there is shown in Figs. 1 and 2 on this page. This board was manufactured and installed by the D'Olier Engineering Company, of Philadelphia, and was well worth inspection.

The large switches, of which there were five, presented some unique features, among which were the handles and the laminated clips, giving good contact between the blades and clips, and allowing the switches to be easily handled. The switches were 1000 amp. each, and had the studs cast in solid with the clip bases. The connections to the studs were made by means of heavy brass castings clamping tightly around the studs and made to receive the connecting bar. These connecting pieces were forced tightly into the clamps and the studs were made of different lengths, which allowed a symmetrical arrangement of the bus bars.

Clamp connections were used entirely for the bus bars, making a piece of work easily erected and absolutely free from heating. The general design of the bus bars, etc., is shown in the accompanying cuts. The board was equipped with Weston instruments, Cutter laminated type circuit breakers and American Electric Heating Company's rheostats.

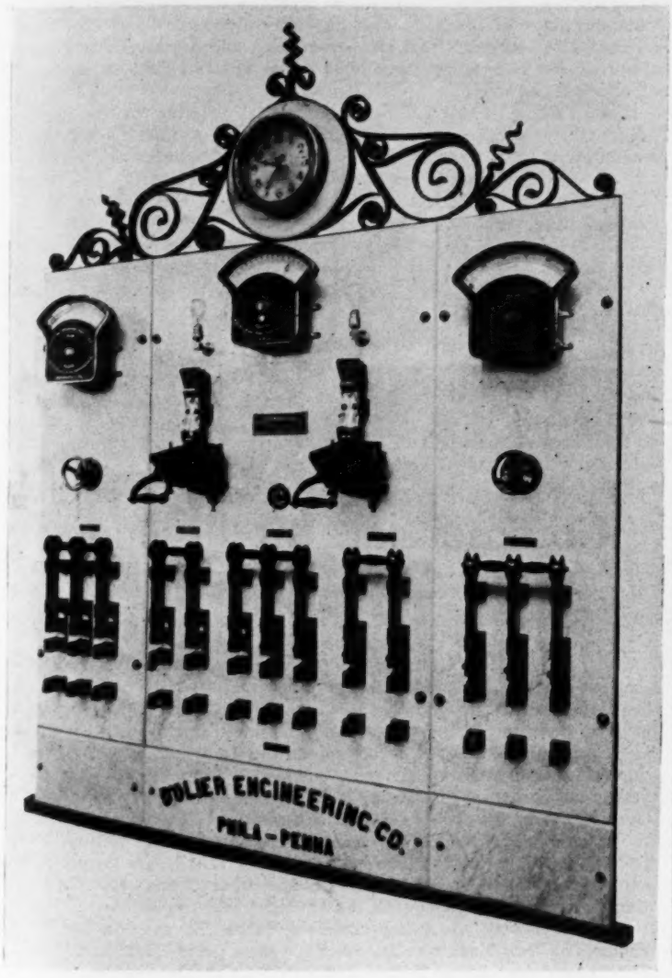


FIG. 1.—FRONT OF SWITCHBOARD.

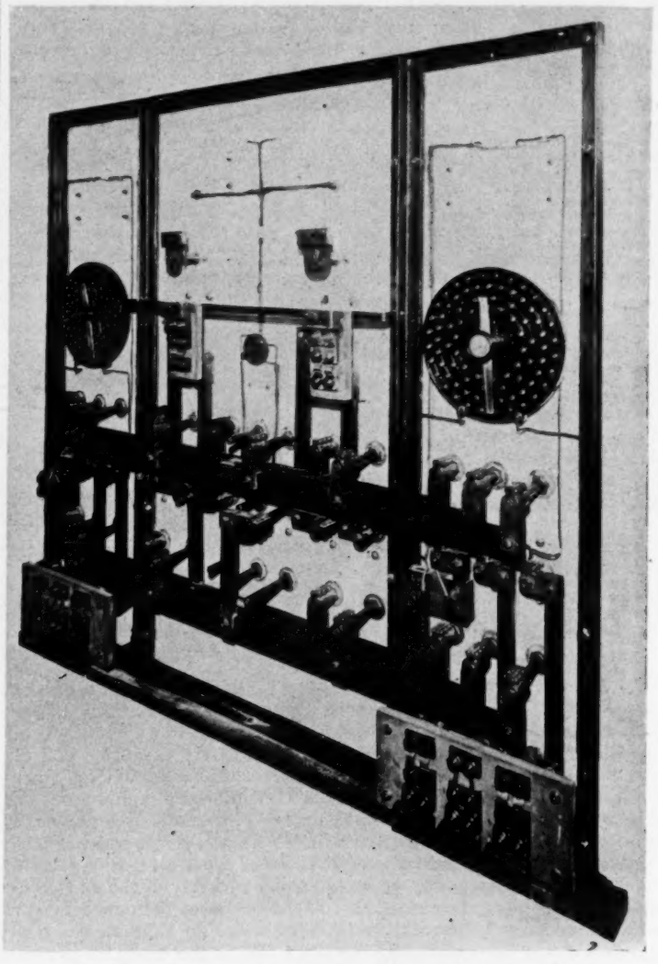


FIG. 2.—BACK OF SWITCHBOARD.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Call money closed at 4 per cent; time money, which was easy, closed at 4¾@5 per cent. Quiet and fairly steady conditions prevailed in the stock market—evidences that security values warrant present quotations. In the traction list, Brooklyn Rapid Transit closed with a net gain of 2½ points, the quotations fluctuating between 60⅜, the lowest, and 63¼, the highest, which was also the closing price on Saturday. Metropolitan Street Railway was weaker, closing with a net loss of 1 point, the range of prices being confined to narrow limits, 154¼ being the lowest and 156¼ the highest, closing at 155. General Electric was firm and steady, transactions being somewhat limited, only 1566 shares having been sold. The lowest figure was 255 and the highest 258¾, which was also the closing price, the net gain for the week being ¾ of a point. Western Union closed at 91⅝, a net gain of ⅛, the sales being 4040. American District Telegraph continues to increase in price, and gained 1¼ points, closing at the highest figure, which was 38¼. This stock has been steadily advancing for several weeks past. Following are the closing quotations of Monday, Nov. 4:

NEW YORK.

	Oct. 29.	Nov. 4.		Oct. 29.	Nov. 4.
American Tel. & Cable..	—	98	General Carriage.....	⅞	¾
American Dist. Tel.....	37½	37	Hudson River Tel.....	112	114
Brooklyn Rapid Transit..	62	62¼	Illinois Elec. Veh. Trans.	—	½
Commercial Cable.....	—	180	Metropolitan Street Ry..	156	154⅛
Electric Boat.....	19½	18	N. E. Elec. Veh. Tran...	—	½
Electric Boat pfd.....	40	45	N. Y. Elec. Veh. Tran...	7	7⅛
Electric Lead Reduc'n...	2¾	2½	N. Y. & N. J. Tel.....	166	167
Electric Vehicle.....	1½	1½	Tel. & Tel. Co. of Am...	—	6
Electric Vehicle pfd....	3½	3½	Western Union Tel.....	91¼	91¼
General Electric.....	256	256			

BOSTON.

	Oct. 29.	Nov. 4.		Oct. 29.	Nov. 4.
Am. Tel. & Tel.....	158	157	Mexican Telephone.....	2	—
Cumberland Telephone...	—	—	New England Telephone.	—	—
Boston Electric Light....	—	—	Westinghouse Elec.....	72*	—
Erie Telephone.....	—	22¼	Westinghouse Elec. pfd..	78*	—
General Electric pfd.....	—	—			

PHILADELPHIA.

	Oct. 29.	Nov. 4.		Oct. 29.	Nov. 4.
American Railways.....	39½	39½	Phila. Traction.....	95¼	95½
Electric Storage Battery.	65	65	Philadelphia Electric....	5	5
Elec. Storage Batt'y pfd.	65	75	Pa. Electric Vehicle.....	½	¾
Elec. Co. of America....	6⅜	6⅝	Pa. Elec. Veh. pfd.....	½	1

CHICAGO.

	Oct. 29.	Nov. 4.		Oct. 29.	Nov. 4.
Central Union Telephone	—	—	National Carbon pfd.....	84	84
Chicago Edison.....	160	159	Northwest Elev. com....	39	39
Chicago City Ry.....	200	—	Union Traction.....	15¾	13¾
Chicago Telep. Co.....	235*	—	Union Traction pfd.....	53	53
National Carbon.....	20⅜	20½			

*Asked.

VULCANIZED FIBRE COMBINATION.—The details of the plans of the American Vulcanized Fibre Company, recently incorporated with a capital of $4,000,000, are set forth in a circular from the directors to the stockholders of the Kartavert Company, one of the four companies consolidated. The circular says, among other things: "The new company will have an authorized capital stock of $3,400,000, of which $900,000 will be 7 per cent cumulative preferred stock and the balance, $2,500,000, will be common stock, and will also have an authorized bond issue of $600,000 of 6 per cent, 20-year gold bonds, secured by a mortgage on the entire property of the new company, such bonds to be redeemable at the option of the new company after three years at 105 and accrued interest. To facilitate the consummation of the transaction outlined above, the directors are requested to deposit their stock with the Security Trust & Safe Deposit Company, of Wilmington, Del., on or before Nov. 15, and such company will issue a receipt by which it obligates itself to either return the stock without any cost on the first of December, 1901, in case the option referred to is cancelled, or on the exercise of the option and a consummation of a sale thereunder to the new corporation to deliver the pro rata proportion to the purchase price paid for the company's stock." This consolidation had been in contemplation for two years. George B. Hanford, of New York, one of the leading organizers, has devoted much time to the perfection of the plan, and largely through his efforts has it been made effective. The next 60 days will see the perfection of the new organization. All the plants are to continue in operation and without material change in the working forces.

CENTRAL UNION TELEPHONE.—Director C. H. Brownell, of the Central Union Telephone Company, while in Boston, stated that the company is seadily extending its business, and that since President Sabin assumed the management fully 15,000 additional subscribers have been secured. The largest development has come in the cities of Indianapolis and Toledo. Plans are now under consideration for new construction work that will involve an expenditure in the immediate future of nearly $1,000,000, and will provide an additional modern equipment that will not be surpassed elsewhere in the country. President Sabin is bringing into vogue very largely the ideas that he used so successfully while he was on the Pacific Coast, and in this connection he is putting into service many new methods which are becoming very popular with telephone subscribers. Mr. Brownell is quite confident that the company has now started in under its reorganization, and with ample working capital in hand, for a greatly enlarged prosperity.

DIVIDENDS.—The directors of the National Carbon Company have declared the regular quarterly dividend of 1¾ per cent on the preferred, payable Nov. 15. The directors of the Cincinnati, Newport & Covington Railway have declared the regular quarterly dividend of ¾ per cent, payable Nov. 2. The directors of the National Bridge Company have declared the first quarterly dividends of 1¾ per cent on the preferred stock and 1¼ per cent on the common stock, payable Nov. 6. The capital stock of this company is $1,500,000, one-half of which is preferred.

ELECTRIC VEHICLE.—At the annual meeting of the stockholders of the Electric Vehicle Company the number of directors was reduced from 13 to 9. The following retiring members were re-elected: H. M. Byllesby, George Chapman, G. H. Day, P. T. Dodge, T. W. Goodrich, Albert A. Pope, A. L. Riker, I. L. Rice and F. C. Stevens.

BOSTON EDISON.—The gas commissioners gave a hearing last week on the petition of the Edison Electric Illuminating Company, of Boston, for authority to issue $750,000 (par) new stock to fund its floating debt and for extensions. The Edison Company was represented by President Edgar and J. Otis Wardwell. There was no opposition.

KEYSTONE TELEPHONE STOCK.—It is stated from Philadelphia that while all the $5,000,000 Keystone Telephone Company stock now being offered has not been taken, subscriptions are stated to have been substantial and to have far exceeded expectations. This is the new independent system to be run in opposition to the Bell.

Commercial Intelligence.

THE WEEK IN TRADE.—The complaints of car shortage of the past few weeks continued last week, and although the latest railway returns indicate that transportation facilities have greatly improved, the Nation's business has expanded more rapidly. From all sections of the country, and many lines of industry, complaints are heard regarding the inability to move goods. The delay has been most aggravating in the case of coal, the unseasonably warm weather alone preventing serious inconvenience in this line. Not only are domestic requirements enormous, but coal is becoming an important article of export, partly owing to labor controversies in France and Great Britain, and also to the British export tax. Notwithstanding the loss of much freight movement through inadequate rolling stock, railway earnings for the month were 7.2 per cent larger than for the same month last year. While the mild weather affects retail distribution to a very marked degree, it is evident that the volume of legitimate business is not being curtailed, since the gain in bank exchanges at New York was 27.4 over the same period last year. There is no particular change in iron and steel; an advance in steel rails of $1 to $2 per ton for next year's delivery is talked of. There is an unprecedented demand at Chicago for finished products and structural material, and at Pittsburg the structural material is largely called for. Copper maintains its former strength, an agreement to restrict production being reported among the great interests. The market is thought to be artificially sustained by closing mines. Quotations are 16.85 cents to 17 cents for Lake, 16.30 to 16⅝ cents for electrolytic, and 15⅝ to 16.30 for casting stock. The business failures for the week, as reported by *Bradstreet's*, aggregated 172, as against 233 the week previous, and 165 the corresponding week last year. *Dun's Review* computes the liabilities of the concerns failing in October at $10,680,627, as against $9,072,791 the same month last year.

ELECTRIC POWER IN BRICK PLANT.—Griese Brothers, Cleveland, Ohio, are preparing to erect a large brick plant. There will be 15 buildings, including a power house, and machinery will be electrically driven.

ANOTHER EXTENSION TO THE BULLOCK WORKS.—Another extension to the Bullock Electric Manufacturing Company's plant has become necessary on account of the volume of orders for heavy machinery that has come to them in the past 60 days. Work has been commenced upon a building to be 250 ft. wide, having a main aisle 75 ft. wide, two side aisles 60 ft. each, and two side aisles 27½ ft. each. This building is planned to be 750 ft. long, but will not be built in its entirety at the present time. Contracts are being let for one-half the contemplated length. It will be electrically driven throughout, having electric traveling cranes in all the aisles, the head room under the crane of the main aisle being 50 ft., with 30 ft. head room in the 60-ft. aisles. The architectural features of the building will conform to those already erected, the walls being of buff brick with structural steel framework. The building is to be rushed to completion with all possible haste, and will provide facilities much needed. The company is also installing at the present time in its own power house a 1000-kw generator direct connected to a cross-compound Lane & Bodley Corliss engine. Its foundry is also being connected by side tracks to the system in the main works, which will permit of the use of its locomotive crane car for delivery of material to and from this portion of the plant.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph Company instrument statement for the month ended Oct. 20 shows:

	1901.	1900.	1899.	1898.
Gross output	95,655	67,198	50,861	33,639
Returned	23,374	30,737	18,044	11,823
Net output	72,281	36,461	32,817	21,816
Since Dec. 20:				
Gross output	778,826	524,362	539,598	278,363
Returned	324,663	220,698	163,271	120,082
Net output	454,163	303,664	376,327	158,281
Total outstanding..	2,406,979	1,884,169	1,501,577	1,077,402

THE NEW PROCESS RAWHIDE COMPANY, Syracuse, N. Y., through its English agents, Messrs. George Angus & Co., has received during the month of October trial orders for its noiseless pinions from no less than eleven of the leading electric railway companies in Great Britain. These trial orders will doubtless lead to a considerable trade in the near future. The company reports its trade in the general machinery line as steadily increasing, especially in the case of motor-driven machine tools where noiselessness is very essential. Since the company's announcement a couple of months ago that it is in position to furnish accurately cut metal gears also, the number of orders received for work in this line has been very gratifying and points favorably to an extended trade.

THE ELECTRIC STORAGE BATTERY CO., of Philadelphia, has recently closed a number of contracts for the installation of batteries of Chloride accumulators in Edison stations. The Chicago Edison Co. has added two batteries to its Adams Street Station, this building now containing the greatest capacity of storage batteries located under one roof in the world. The Philadelphia Electric Company has added another battery to its system, and the Edison Electric Illuminating Company, of Detroit, has doubled the capacity of its installation. The Edison Electric Light Company, of York, Pa., and the St. Paul Gas Light Company, of St. Paul, Minn., have each contracted for a large battery to be installed in their lighting stations.

NEW STURTEVANT FACTORY.—Work is rapidly progressing upon the foundations for the new plant of the B. F. Sturtevant Company at Hyde Park, Mass. The buildings, including storage space between, will occupy a tract measuring in extreme dimensions about 500 ft. by 700 ft. This will provide space for the foundry, pattern and pattern storage building and power plant as well as the machine shop, 120 ft. by 500 ft., and a three-story structure of the same length, both terminating in a large head house, which will serve for the work of erecting, testing and shipping. The office will be a separate building of considerable dimensions.

SECOND-HAND EQUIPMENT.—The Standard Machinery & Equipment Company, of Cleveland, has recently assisted in closing a deal for the purchase by McDowell & Co., of Pittsburg, of a large lot of power and electrical equipments from the various sub-stations of the Cincinnati Gas & Electric Light Company, which is dismantling the plants, having a large central station under erection. Among the apparatus were four 500-hp Corliss engines, two 450-hp engines, twenty 150-hp boilers, three 150-kw direct-connected Westinghouse generators, and two 200-kw Wood alternators. Two of the plants were sold complete to Rossiter, MacGovern & Co., New York.

THE S. MORGAN SMITH COMPANY, York, Pa., has lately received an order for six single 39-inch and one 18-inch McCormick turbines from the Metabetchouan Pulp Company, Quebec. Each turbine will be mounted in an iron flume connected to a supply pipe 16 ft. diameter. Five of the 39-inch turbines will develop 4000 horse-power, and drive 10 pulp grinders. Another of the same size will drive the wet machines, screens and other machinery. The 18-inch will operate a dynamo. The head is 46 ft. The mill will have a daily capacity of 60 tons pulp, dry weight.

PRICE LISTS FOR SIBERIA.—Consul-General Hughes, of Coburg, under date of Oct. 10, 1901, says: The trade bureau of the Siberian Railroad publishes a notice that it wishes to have price lists, illustrated catalogues, etc., of all kinds of goods which are necessary and useful in Siberia. The chief of the bureau requests that price lists, sample cards and catalogues be addressed to Monsieur N. Selikhoff, Service Commercial du Chemin de fer Grand Siberia, Tomsk, Russia.

POWER PLANT PROPOSALS.—The McMyler Manufacturing Company, of Cleveland, manufacturer of hoisting and conveying machinery, is erecting a new plant at Warren, Ohio, and has called for proposals on the equipment of a power plant. Among the apparatus required are a 100-kw, 250-volt generator, direct connected; two 100-hp horizontal boilers, with mechanical stokers; feed-water heaters for 300 horse-power and feed pumps for the same. A number of motors will also be required.

WESTINGHOUSE EQUIPMENT FOR TORONTO.—The projected plant of the National Portland Cement Company, Limited, to which reference was made in our last issue, is to be equipped electrically with some $60,000 worth of machinery manufactured by the Westinghouse Electric & Manufacturing Company. The John A. Mead Manufacturing Company, New York offices, the Bowling Green Building, is to furnish apparatus to be utilized for the handling of hot clinkers in the Canadian plant.

THE ECONOMY ELECTRIC COMPANY, of Warren, Ohio, opened a new factory building a few days ago and celebrated the occasion with a banquet to its employes and those of the Warren Electric & Specialty Company, an affiliated company. The plant gives the Economy Company double its former capacity. Officers of the company have recently been elected as follows: T. H. Gillmer, president; P. L. Webb, vice-president; E. W. Gillmer, secretary-treasurer, and J. W. Holloway, assistant secretary-treasurer.

VARIOUS CAMP CONDUIT CONTRACTS.—The H. B. Camp Company, of Akron, Ohio, New York offices, Park Row Building, reports receipt of contracts calling for the furnishing of 350,000 ft. of vitrified clay conduits for the United Electric Company, Newark, N. J.; 150,000 ft. for the Interstate Telephone Company, of Trenton, N. J., and a substantial order from the North Jersey Street Railway Company, of Newark, N. J.

CRANE COMPANY ERECTS PLANT IN RUSSIA.—The Crane Company, of Chicago, Ill., has just completted the erection of an extensive plant at St. Petersburg, Russia, for the mannfacture of piping and other products of the company. The new works adjoin those of the Russian Westinghouse Air Brake Company, and are the second shops of the kind to be built in Russian territory for the turning out of American specialties.

ELECTRIC TRAIN LIGHTING.—The Pullman Company has just finished and delivered to the Louisville & Nashville Railroad Company three elegant dining cars equipped with the "Axle Light" system of the Consolidated Railway Electric Lighting & Equipment Company. No auxiliary light has been provided in these cars. One of these cars will run between Cincinnati and Louisville, and two between Birmingham and New Orleans.

CITIZENS' ELECTRIC LIGHT COMPANY at Rochester, N. Y., which proposes to offer an active competition to the existing system there is understood to have just closed a large and important contract with the Stanley Electric Manufacturing Company for five or six large two-phase generators to be used with three-wire circuits. Other contracts are being placed.

THE ELECTRIC CONTROLLER & SUPPLY COMPANY, of Cleveland, Ohio, will occupy part of the new plant being erected by the Wellman-Seaver Engineering Company as soon as it is completed, which will be about the first of the year. The new quarters will give the company several times its present capacity for turning out electric controllers.

BOLT AND NUT MACHINERY FOR ENGLAND.—The Acme Machinery Company, of Cleveland, manufacturer of bolt and nut machinery has just made a large shipment of tools to the British Westinghouse Company.

CONTRACTS FOR POWER PLANT.—The Vulcanus Forging Company, of Cleveland, will soon close contracts for a new power plant, and will be on the market for a lighting generator; also motors.

TROLLEY BRIDGES.—It is announced from Cincinnati, that the Lackawanna & Wyoming Electric Railway has contracted with the Dayton (Ohio) Construction Company for 50 bridges to be built on its lines in Pennsylvania.

THE BURT MANUFACTURING COMPANY, of Akron, Ohio, announces Government orders for its Cross oil filters for the battleship "Illinois" and the torpedo boat "Bainbridge."

FEDERAL BATTERY COMPANY is announced to have been dissolved by the stockholders.

EXPORTS OF ELECTRICAL MATERIAL AND MACHINERY.—The following are the exports of electrical material, machinery, etc., from the port of New York for the week ended Oct. 30: Antwerp—Material, 18 pkgs., $1,038; machinery, 2 pkgs., $61. Bristol—Materials, 2 pkgs., $50; machinery, 12 pkgs., $1,073. Bucharest—Machinery, 1 pkg., $30. Bremen—Materials, 3 pkgs., $148. Berlin—Machinery, 14 pkgs., $100. British Possessions—Machinery, 1 pkg., $100. Bolton—Machinery, 6 pkgs., $520. British Australia—Materials, 1 pkg., $10. British Possessions in Africa—Machinery, 2 pkgs., $235; materials, 85 pkgs., $5,308. Baden—Materials, 5 pkgs., $750. Brazil—Materials, 8 pkgs., $351. British East Indies—Materials, 5 pkgs., $278; machinery, 14 pkgs., $4,600. Cuba—Machinery, 24 pkgs., $1,560. Central America—Materials, 15 pkgs., $301. Ecuador—Machinery, 2 pkgs., $89. Glasgow—Materials, 7 pkgs., $88; materials, 7 pkgs., $312; machinery, 4 pkgs., $421. Genoa—Materials, 1 pkg., $67. Havre—Machinery, 3 pkgs., $280. Hamburg—Machinery, 5 pkgs., $170; materials, 30 pkgs., $1,090. London—Machinery, 82 pkgs., $7,935; 36 pkgs., $1,841. Mexico—Materials, 13 pkgs., $371. Manchester—Machines, 21 pkgs., $3,035; materials, 1 pkgs., $21; materials, 10 pkgs., $283; materials, 3 pkgs., $126. Nova Scotia—Machinery, 12 pkgs., $1,000. Southampton—Machinery, 122 pkgs, $809; machinery, 3 pkgs., $188. San Domingo—Material, 6 pkgs., $232. Venezuela—Material, 108 pkgs., $1,699. British Guiana—Material, 2 pkgs., $17. British East Indies—Material, 16 pkgs., $438. Cuba—Material, 152 pkgs., $4,586. Dutch East Indies—Material, 4 pkgs., $72. Florence—Material, 8 pkgs., $532. Liverpool—Machinery, 22 pkgs., $3,264; materials, 153 pkgs., $10,723. London—Materials, 214 pkgs, $9,294. Mexico—Railway material, 303 pkgs., $9,945. New Foundland—Material, 8 pkgs., $206. Peru—Machinery, 118 pkgs., $2,188. U. S. Colombia—Material, 2 pkgs., $30.

AS TO COPPER.—Messrs. Hayden, Stone & Co. are sending their correspondents and customers the following review of the copper situation: The production of the metal for 1900 in this country was 602,000,000 lbs., and the figures so far as published for 1901 do not indicate that there will be any increase. During 1900 domestic consumption was 348,000,000 lbs. and the exports 352,000,000 lbs., amounting to 700,000,000 in all, and as the imports were 103,000,000 lbs., that accounts for the entire production. This year present figures indicate that the exports for 1901 will not exceed 250,000,000 lbs., and that, owing to the reselling of stocks on hand held abroad, the imports will be from 150,000,000 to 160,000,000 lbs., so that, whereas last year there was a net export over imports of 250,000,000 lbs., this year the net exportation will be less than 100,000,000 lbs. One of the large items in this decrease is in exports to Germany. The situation there seems to us to be practically parallel with the situation that exisited here eight years ago. The electrical concerns in Germany are besieged with orders and could easily obtain $30,000,000 of new business if they could swing it, but they have already accepted between $40,000,000 and $50,000,000 of business which they have been filling where they have received their pay in notes or securities, and they have burdened the financial institutions of the country with the carrying of these notes by discount or rehypothecation as collateral. We have no doubt that so soon as these financial obligations have been taken care of by proper distribution and digestion, that the demand for electrical machinery will cause another period of prosperity in the trade such as the General Electric Company in this country is enjoying to-day.

BALL ENGINE ORDERS.—The Latrobe Steel Company, Latrobe, Pa., is about to install an electric power plant in its works. One 300-hp and one 80-hp engine will be furnished by the Ball Engine Company, Erie, Pa. The Sagamore Coal & Coke Company, Bramwell, W. Va., will be equipped with an electric power plant. The Ball Engine Company will furnish a 300-hp side crank engine for the necessary power. The Cloquet Lumber Company, Cloquet, Minn., has recently ordered for its electric plant a Ball 225-hp horizontal tandem compound engine, direct connected to 132-kw Westinghouse alternating machine. The Ball Engine Company will furnish engines direct connected to generators for the post office at Philadelphia, and is installing a 450-hp vertical cross-compound engine in the plant of the Minneapolis General Electric Company. It is also building for the same company a 700-hp vertical cross-compound with Corliss valves. The city of Bangor, Me., has recently purchased a 500-hp engine for its electrical plant, from the Ball Company. The Brown Hoisting Machine Company, Cleveland, Ohio, has purchased from the Ball Engine Company, Erie, Pa., for power and lighting, two 450-hp tandem compound direct-connected engines. The contract for the engines for the electric power plant of the Chicago University has been awarded to the Ball Engine Company. There will be one horizontal Corliss valve cross compound of 600 horse-power and one of 450 ihp.

COAL-HANDLING EQUIPMENTS FOR VARIOUS POWER PLANTS.—The John A. Mead Company, whose New York offices are in the Bowling Green Building, reports receipt of several substantial contracts for its coal and ash handling machinery to be installed in various electrical power stations throughout the country. The list includes a $35,000 equipment, having a capacity for handling 45 tons of coal and ash per hour, for the northern power station of the St. Louis Transit Company. A $10,000 outfit is to be furnished the Denver Tramway & Power Company. The United States Electric Light Company, of Washington, D. C., has requisitioned for an outfit to be installed in an extension of its present boiler plant. The value of this contract is $6,000. The boilers are being supplied by the Babcock & Wilcox Company. The St. Louis Belleville & Suburban Railway Company is to have a $9,000 coal and ash handling equipment. The Mead Company has also lately secured some important contracts for its specialties from the United States Government, mining companies, etc. The principal contract obtained through the latter source came from the Quincy Mining Company, of Houghton, Mich., which is to be equipped with some $150,000 worth of coal handling machinery. The equipment will be utilized for taking coal from vessels to storage and from there to cars for reshipment. The plant will have an hourly capacity of 300 tons.

THE OLD WALKER PLANT.—It is denied at the Cleveland office of the Westinghouse Electric & Manufacturing Company that the old Walker plant which has been operated by the company for the past two years is to be abandoned and the entire plant removed to Pittsburg. The report arose from the fact that the local factory manager has called for bids on a large list of tools used in the manufacture of motors, the production of these goods having been abandoned in Cleveland.

LIGHTING BEET SUGAR PLANTS.—The Kilby Manufacturing Company, Cleveland, has just closed contracts for four large beet sugar plants to be erected in various parts of the country. Each will be equipped with a lighting plant, which will be purchased by the Kilby Company.

THE WILLIAMS-ABBOTT ELECTRIC COMPANY, of Cleveland, will soon open a Chicago office in charge of Harry C. Dodge, who was formerly identified with the company in Cleveland. The company has recently commenced making shipments of the small exchange magneto switchboard, which it has recently brought out. Within the past 30 days 50 have been shipped to various parts of the country. In the near future the company will announce a new central energy board, which is now under construction. The company reports that there has been a marked improvement in business during the past month.

MOSSBERG & GRANVILLE MANUFACTURING COMPANY.—Several important changes have recently been made in the management of the Mossberg & Granville Manufacturing Company, Providence. At the recent election the following, who have not heretofore been associated in the management, were made directors: W. W. Orr, V. I. Cunnock, E. C. Moen, A. R. Whitney, Jr., and Joseph W. Harriman, all of New York, and Elisha H. Howard, of Providence. The board of directors organized by electing Howard C. Smith, of New York, president; Elisha H. Howard, vice-president, and E. C. Moen, secretary and treasurer. V. I. Cunnock was made chairman of the executive committee. The resignation of W. W. Gibbs, for some time past general manager, was accepted, and in his place George A. Clark, formerly of Lowell, Mass., has been appointed. The business of the company at the present time is in a flourishing condition, and various new patterns of tools and machines have been added to its already extensive list. The New York office of the company (secretary and treasurer) is at 100 William Street.

SCHLESINGER & MEARS is the name of a new firm of manufacturers' representatives which has appeared in New York City, Mr. F. H. Schlesinger, formerly manager of sales for the Peru Electric Manufacturing Company and Mr. James A. Mears being the members of the firm, with offices at 220 Broadway. The object of the new firm is the sale of electrical specialties to the trade as manufacturers' representatives, and they have the following specialties to offer: Incandescent lamps, a full line of sockets, rosettes, cut-outs, receptacles, mains and branches, insulators, cleats, tubes, knobs and special porcelains for the trade.

ALUMINUM.—An American aluminum association has recently been formed by concerns manufacturing or dealing in aluminum goods, an indication of the growing use of the metal. The president is Mr. J. A. Steinmetz, of Janney, Steinmetz & Co., of Philadelphia; first vice-president, W. F. Pflueger, of the Manitowoc (Wis.) Aluminum Novelty Company; second vice-president, W. H. Wagner, of the Wagner Manufacturing Company, Sidney, Ohio; and secretary-treasurer, Palmer H. Langdon, of New York.

THE REMY ELECTRIC COMPANY, which has been recently incorporated at Anderson, Ind., will manufacture the Remy magnetos for gas and gasoline ignition purposes. The capital stock is $10,000. They have a well-equipped factory plant, working 20 men, with a capacity of 15 machines daily. The active members of the concern are Messrs. B. P. Remy and F. I. Remy.

General News.

THE TELEPHONE.

HARTFORD, CONN.—Plans have been completed by the officials of the Southern New England Telephone Company for doubling the facilities of the company in this State.

AUGUSTA, GA.—The City Council has decided that all wires must go underground in 1912. This was the result of a proposed amendment to a previous ordinance offered, requiring corporations in the city to put their wires underground in two years.

WILMINGTON, DEL.—The Inter-State Telephone Company has just completed an extension of its lines to Middle Sound.

EDWARDSVILLE, ILL.—The war on telephone rates caused by the entrance of the Kinloch Telephone Company into territory which had previously been exclusively that of the Central Union system has commenced by the latter company announcing a general reduction of rates.

WASHINGTON, IND.—An independent telephone company has been granted a franchise at Washington.

TERRE HAUTE, IND.—The Central Union Telephone Company will in the near future run a line from Terre Haute to Sandford.

INDIANAPOLIS, IND.—The Big Springs Co-operative Telephone Company has been incorporated; capital stock, $200. Directors: J. O. Parr, J. W. Reed, W. E. Beatty, E. H. Stephenson and A. C. Poppino.

MORGANTOWN, IND.—The Morgantown Telephone Company, recently organized, opened its exchange for business on Nov. 1. It has 40 subscribers, and a switchboard capacity of 100 drops. It is constructing 20 miles of toll line, and other extensions are projected. The American system is used.

MONONA, IA.—The Monona Telephone Company has decided to extend its lines from Whiting to Sloan by way of Lossing and Albaton.

SLOAN, IA.—Harter Bros., proprietors of the Correctionville telephone exchange, have purchased the local exchange at Cherokee and will connect the two.

SMITHLAND, IA.—The Town Council at Smithland has granted a franchise to the New State Telephone Company, which is building a line up the Little Sioux Valley from Mapleton to Correctionville.

DES MOINES, IA.—The Protivin Telephone Company has been incorporated; capital stock, $4,000. Frank J. Fencl, John Fencl, Joseph Bouska, Fred. Lukes and Frank Galishek, Albert M. Kesh, John Bouska and John A. Dostal are the incorporators.

DES MOINES, IA.—The Vinton & Benton County Telephone Company has filed articles of incorporation with the Secretary of State. It has a capital stock of $100,000, and its directors include F. G. Ray, Geo. Knox, W. C. Ellis, C. C. Griffin, M. McNie, W. H. Hanna and G. M. Gilchrist.

WICHITA, KAN.—The City Council granted a franchise to Frank T. Brown to construct and maintain a telephone and conduit system in this city.

TOPEKA, KAN.—For the purpose of constructing telephone lines in Oklahoma and Indian Territory Frank L. Brown, Cyrus Leland, Morton Albaugh, Orie Morse, I. E. Lambert and C. A. Jobes have formed a company and secured a franchise to put in an exchange at Wichita.

COVINGTON, KY.—The Kentucky Telephone Company, recently organized here, will start its exchange about Dec. 1, using the National Automatic system. It will have a switchboard capacity of 100 drops, and 50 subscribers. Its charges will be $1 per month for residence instruments and $1.50 for business.

BRUNSWICK, ME.—A syndicate of Brunswick men are to establish a telephone line to Harpswell connecting at Brunswick with the line already established.

BATTLE CREEK, MICH.—The Calhoun County Telephone Company of this city has increased its capital stock to $100,000.

IONIA, MICH.—The Citizens' Telephone Company of Grand Rapids, Mich., is building its manholes at Ionia of Portland cement, and Superintendent Stacey claims that they are the first telephone manholes in the world, so far as he has been able to learn, constructed of this material. Manholes are generally constructed of brick, but the company is experimenting with cement, and believes them to be far superior to those of brick in a number of respects, while the cost is said to be much less. All of the company's manholes in the State will hereafter be constructed of cement.

JACKSON, MISS.—The Booneville & Tupelo Telephone Company has been chartered; capital, $2,000. Phillips, Hinds & Company, W. R. Whiteside & Company, B. A. P. Selman and others are the incorporators.

FARMINGTON, MO.—The Farmington Telephone Company has filed a statement of increase of capital stock from $5,000 to $10,000.

JEFFERSON CITY, MO.—The Citizens' Telephone Company of North Missouri, of Monticello, has been incorporated; capital, $1200. Incorporators: Cyrus C. Raine, Pike Hanna, Charles Little and others.

HAMILTON, MO.—Leo Brown, who recently purchased the Breckenridge telephone exchange, has been granted a franchise by that city, and will pay the city two per cent. of the gross receipts and furnish the city hall a free telephone.

AURORA, NEB.—An independent telephone company has been organized at this place, which will have exchanges at Aurora and Bromfield and supply farmers with telephones.

PLATTSMOUTH, NEB.—An independent telephone company has been organized at Aurora, Neb., which will be known as the Hamilton County Farmers' Telephone Association. Exchanges will be put in at Aurora and Bromfield and the entire county will be wired and telephones placed in many of the farm houses.

STATESVILLE, N. C.—The Statesville Telephone Company has been chartered, with a capital of $10,000. Mrs. Burton, of Marion, N. C., is the principal stockholder.

TRENTON, N. J.—The Inter-State Telephone Company intends to erect a new exchange building in Paterson, to cost $50,000.

TRENTON, N. J.—Hugh H. Hamill and Barker Gummere, of this city, representing the Inter-State Telephone Company, have signed papers for the purchase of the Atlantic Telephone Company, which has 100 telephones in operation.

LOWVILLE, N. Y.—The Black River Telephone Company will build a line from Copenhagen to Adams, Henderson, Sacketts Harbor and Watertown.

ALBANY, N. Y.—The Otsego County Telephone Toll Line Company has been incorporated; capital, $10,000. Directors: John Geer, L. Barker and John A. Losee, of Richfield Springs.

ROCHESTER, N. Y.—The Rochester Telephone Company has determined to add long-distance connections to its service. A contract between the local company and the Inter-Ocean Telephone & Telegraph Company has been entered into, whereby the Rochester Company is to have connections east and west. The work of constructing the long-distance line will be commenced at once.

SOUTH SOLON, OHIO.—The Bell Telephone Company will have about 50 subscribers in opening its new exchange at this place.

COLUMBUS, OHIO.—The property of the Columbus Citizens' Telephone Company has been placed on the tax duplicate at $250,000.

HAMILTON, OHIO.—Wire thieves cut down a large section of overhead cable here a few days ago, greatly demoralizing the telephone service of the city.

JACKSON, OHIO.—The Jackson County Home Telephone Company has over 700 subscribers and has from 100 to 150 instruments connected in Jackson and the same number in Wellston.

TIFFIN, OHIO.—The Flat Rock Telephone Company, of Flat Rock, Seneca County, has been incorporated with $5,000 capital stock by C. C. Pfund, T. E. Wygant, S. D. Huff, E. L. Leinhard, W. H. Gardner and F. E. Harris.

LISBON, OHIO.—The Columbiana County Telephone Company is installing an additional switchboard in its exchange here. The company has 300 telephones in operation in the town and many applicants for service are waiting the completion of the board.

POMEROY, OHIO.—Franchises have just been granted to L. K. Mihill and associates, the Home Telephone Company, of Coolville, and to John McQuigg and W. H. Osborn, of this city. Each of the three companies has agreed to furnish the city six telephones free of charge.

FINDLAY, OHIO.—An injunction has been granted against the Findlay Home Telephone Company restraining it from charging more than $12 per year for residence service. Recently the company improved its residence lines and attempted to increase the figure over that agreed upon in its franchise .

CINCINNATI, OHIO.—The City & Suburban Telegraph Association is extending its service gradually into all the important suburbs. Wyoming, Madisonville and Delhi are now all possessors of independent exchanges under control of the Cincinnati office, and Norwood is the latest applicant for an exchange.

MILLERSBURG, OHIO.—The Millersburg, Wooster & Orrville Telephone Company, which controls exchanges in Holmes and Wayne counties, held its third annual meeting a few days ago. Frank L. Beam, John M. Ewant and D. E. Sapp were added to the directorate and Mr. Beam was elected vice-president.

CLEVELAND, OHIO.—Hon. H. D. Critchfield, general counsel of the Federal Telephone Company and allied properties has returned to his duties at headquarters after an illness of several months. A month ago he attempted to take up his work, but after a day or so he was obliged to return to his home at Mt. Vernon.

TOLEDO, OHIO.—The capital stock of the Toledo Home Telephone Company has all been subscribed, nearly all of it being taken by Toledo people. Over 100 residents of the city have subscribed amounts ranging from $5,000 to $20,000. The day after the subscription closed, a Toledo capitalist offered to take $100,000 of the stock, but he could not be accommodated. A contract for the erection of a fine exchange building has been awarded.

PORTSMOUTH, OHIO.—The Portsmouth Telephone Company (independent) is making a special canvass for farmer lines through the surrounding country. Contracts enough have been secured to warrant the installation of exchanges in Harrisonville, Wallace Mills, South Webster, and all intermediate points between Portsmouth and Rarden have been canvassed and contracts secured. Lines will be built to Maysville, Ky., and connecting with the independent exchange at that point.

WEST JEFFERSON, OHIO.—The Farmers' Mutual Telephone Company has closed a deal with the Central Union Telephone Company, whereby its system will be connected with the long distance system of the Bell Company. The Farmers' Company is one of the most extensive of its kind in the country, and it was started several years ago by a farmer who built a line to connect with his nearest neighbor. Others were soon connected and each farmer built and paid for his own line. Jointly they paid for individual switchboards located in various farm houses which they attended to without compensation, receiving service for less than $5 per year. The affiliated lines at present touch the following towns: Mechanicsburg, Roseville, Rosedale, Lafayette, Milford Center, Plumwood, Catawba, Alton, Galloway, Rome, Hilliards, Georgesville, Lilly Chapel and Gillivan, giving connection to about 700 subscribers. Recently they organized the company mentioned. Under the new arrangement an exchange will be located at West Jefferson, and long distance telephones with metallic circuits will be leased by the Bell Company.

CLEVELAND, OHIO.—President B. G. Hubbell, of the Consolidated Telephone Company, which is building an extensive system in New York State, has completed a deal for the purchase from the Rochester Telephone Company of over 100 miles of toll lines connecting towns in the vicinity of Rochester. The lines will be improved and will be connected with the long distance system of the Consolidated Company. The Rochester exchange, which is the largest independent system in New York State, having about 4200 subscribers, is to be improved and equipped with new switchboards giving an ultimate capacity of

10,000. The Consolidated Company has also acquired the automatic system at Geneva, N. Y., and will equip it with a multiple central energy board. The exchange has 200 subscribers. The Inter-Ocean Telephone Company, which is the long distance branch of the Consolidated, is just completing its line to Olean, N. Y., the western terminus of the system, where connection will be made with the lines of the Union Telephone & Telegraph Company, of Erie, Pa., which in turn connect with those of the United States Telephone Company, of Cleveland. The Consolidated Company has just completed a deal with the Friendship Telephone Company of Friendship, N. Y., whereby the company ceases on Jan. 1 to be a licensee of the Bell Telephone Company and becomes affiliated with the independent system. The company has paid an annual tribute of $5 per year for the use of each transmitter and receiver and has been obliged to buy the balance of the telephone instrument. Under the new arrangement the Friendship Company will buy its instruments outright from the Century Telephone Construction Company, which is the manufacturing company affiliated with the Consolidated Company.

EL RENO, OKLA.—A telephone company has been granted a franchise at El Reno.

NORTH EAST, PA.—The new telephone line from Sherman to Mina is to be extended to Findlay Lake.

WELLSBORO, PA.—Efforts are being made to establish a telephone line between Liberty Borough and Roaring Branch and Canton.

McKEESPORT, PA.—It is reported that the Federal Telephone Company, which recently purchased the McKeesport Telephone Company's lines here, and the Pittsburg & Allegheny Telephone Company, will consolidate their lines in McKeesport.

MONTREAL, QUE.—The directors of the Windsor Hotel Company, of Montreal, have decided to establish a system of inter-communicative telephones throughout the big hotel. These telephones will number 400 or more, the idea being to place one in each of the guest's rooms. They will have communication with the Bell Telephone system of the city, as well as the long distance telephone, so that without leaving their rooms, those in the hotel may be able to converse with business houses outside and arrange business concerns. Tenders will be invited soon for the installation, which it is anticipated will be completed during the coming winter months.

BRISTOL, TENN.—The Holston Telephone Company is extending its lines and otherwise improving the property owned by the company in Carter County.

NASHVILLE, TENN.—The Richland Telephone Company, of Grainger County, has been incorporated by W. A. Frazier, A. C. Foster, W. S. Stone, Samuel McKinney and Samuel McBee.

SALTILLO, TENN.—The Cumberland Telegraph & Telephone Company is having poles placed between this place and Swallow Bluff, and will at once extend its line to that point. This town has never before had any telephone service.

NASHVILLE, TENN.—The telephone companies of Tennessee are coming forward in a satisfactory manner with the cash for the payment of their privilege taxes. The Cumberland Telephone Company reports privilege taxes amounting to $4,400.

CHATTANOOGA, TENN.—Information has been received that the Supreme Court has handed down a decision sustaining Chancellor Bearen in the Wilcox injunction case appealed. In the bill it is alleged that the City Council through questionable methods passed a franchise for an underground telephone system and all underground rights for gas, etc. Taxpayers filed a bill for an injunction and to declare the ordinance void. Now the Supreme Court upholds the decision of the Chancellor in favor of the taxpayers.

HOUSTON, TEX.—The Mansfield Telephone Company has amended its charter so as to extend its line.

LONE OAK, TEX.—The Citizens' Telephone Company, capital stock $4,000, has been incorporated by W. W. Pattillo, W. C. Bellah, W. G. Patterson, and others.

AUSTIN, TEX.—The Trans-Texas Telephone Company, of Caldwell, Burleson County, has been chartered; capital stock, $50,000. Incorporators: J. D. Giddings, James S. Giddings and Robert S. Leonard.

SALT LAKE CITY, UTAH.—Geo. W. Wotten, a representative of the Rocky Mountain Bell Telephone Company, Salt Lake City, has been in Rexburg making arrangements to put in a telephone exchange. Mr. Wotten has succeeded in getting the assurance of twenty business firms to take the service, with the probability of several other firms joining later on.

SALT LAKE CITY, UTAH.—The Rocky Mountain Bell Telephone Company has been making some extensive changes in its lines in Ogden during the past few weeks. The lines have been extended to many parts of the city and county. Three new cables have been placed, with 100 wires in each cable, and provision for 100 more wires were made. This will enable the company to meet the demands of the public for telephones. The reduced limited rates which the company has introduced in Ogden has led many of the business men to put telephones in their homes. Besides the extensive line work that has been necessitated by the increase of the company's business, a new switchboard has been placed in position and two more operators have been added to the force, making seven operators in all.

FREDERICKSBURG, VA.—The Snickerville Telephone Company will extend its line from Bluemont to Upperville.

JANESVILLE, WIS.—The Badger State Long Distance Telephone Company has been reorganized.

MADISON, WIS.—The Antigo Telephone Company has been incorporated; capital stock, $25,000. The incorporators are M. Spencer Koebke, J. C. Spencer and Richard Koebke.

RHINELANDER, WIS.—The capital stock of the Oneida & Vilas County Telephone Company has been increased to $40,000 for the purpose of building a toll line from this city to Merrill.

ELECTRIC LIGHT AND POWER.

WHITTIER, CALIF.—An electric plant is to be established at Whittier.

ALAMEDA, CALIF.—The City Trustees of Alameda have planned to install additional generators and an engine at the municipal electric lighting plant in that city.

SAN FRANCISCO, CALIF.—The Southwest Gas & Electric Company has been incorporated, with Los Angeles as the principal place of business. Directors: H. Fisher, F. Ringe, J. S. Torrence, J. B. Miller, H. H. Sinclair, W. R. Statts, J. H. Holmes, J. S. Cravens and W. S. Wright. Capital stock, $1,000,000; subscribed, $4,500.

WILMINGTON, DEL.—The United Railway & Light Company, of Wilmington, has been chartered at Dover. It is to furnish light, heat and power for electric railways. Capital, $1,000,000.

GRIFFIN, GA.—The development of High Shoals in Monroe County, which is said to be one of the finest water powers in the State, will be started as soon as plans are perfected. It is rumored that the capital stock of the new company will be $100,000. Hon. Seaton Grantland, of Griffin, is interested.

CHICAGO, ILL.—The Economy Light & Power Company, Chicago, has increased its capital from $400,000 to $850,000.

LAFAYETTE, IND.—The Consolidated Railway, Electric Lighting & Equipment Company has provided for Purdue University a complete electric car lighting outfit. This is being installed in the electrical laboratory for the use of engineering students in studying train lighting appliances. The dynamo and controlling apparatus, which make up the chief part of the equipment, are all of special design and embody in a very skillful way principles for the control and regulation of the electric pressure supplied to lamp terminals.

BALTIMORE, MD.—The Patapsco Electric Light & Power Company will have its wires strung to Catonsville within a few weeks. Mr. Arthur C. Montell, cashier of the First National Bank, of Catonsville, is soliciting subscriptions for incandescent lights and is meeting with much success.

FORT BENTON, MONT.—Causey Brothers, of the electric light company, have sold the plant to a stock company, which has been incorporated. The principal stockholders are J. H. Causey, Charles Causey, C. E. Duer, T. C. Power, W. K. Harbor, James Townsend, J. V. Carroll and L. D. Sharp. Mr. Sharp will be secretary and treasurer.

LEBANON, MO.—The entire stock of the Lebanon Light & Magnetic Water Company, a corporation composed exclusively of local capitalists, was sold Oct. 30 to James Garneau, of St. Louis, for $25,000.

ST. CHARLES, MO.—The St. Charles Electric Light & Power Company has been incorporated, with a capital stock of $30,000, with the following incorporators: J. D. Houseman, F. E. Meseu and W. J. Murray.

GREENSBORO, N. C.—The Greensboro Electric Company has awarded to Mr. A. J. Dunn a contract for the erection of its power-house in this city.

ALBANY, N. Y.—The Ithaca Light & Power Company has been incorporated with a capital of $400,000, with the right to acquire and operate a lighting and water supply plant in Ithaca. The directors are George S. Sheppard, Thomas W. Summers and William T. Morris, all of Penn Yan.

VERSAILLES, OHIO.—Citizens of Versailles have decided to issue $10,000 bonds for an extension of the waterworks and municipal lighting plant.

ST. CLAIRSVILLE, OHIO.—A proposition to issue $25,000 in bonds to improve the electric light plant has carried by the voters of St. Clairsville.

MADISONVILLE, OHIO.—This village will vote Nov. 11 on the question of issuing $25,000 in bonds with which to enlarge the electric light and water plant.

AKRON, OHIO.—The Northern Ohio Traction Company has announced that it will make a reduction in its lighting rates in Akron about Jan. 1, when a new 1000-kw Westinghouse generator will be placed in operation exclusively for lighting purposes.

CLEVELAND, OHIO.—Councilman Springborn is back of an agitation to secure a municipal lighting plant in Cleveland. At his instigation a bill may be introduced in the next Legislature to provide for a bond issue for the purpose of establishing a plant.

CINCINNATI, OHIO.—The Fordyce syndicate, which is improving the Miami and Erie Canal, with a view of operating boats by electricity between Cincinnati and Toledo, has offered to purchase all the boats of the various lines operating between Cincinnati and Dayton.

OTTAWA, ONT.—The Capital Power Company, of Ottawa, has awarded its contract for the improvements it intends making to its water power at Deschenes, six miles from the city. The work will consist chiefly in cutting a large channel, about 250 feet long to a depth of seven feet beneath the surface of the water. It is expected by this means to add about 3000 horse-power to its present capacity. A large amount of machinery will be required in the operations, which will be submarine in character. The work will cost in the neighborhood of $25,000.

THE DALLES, ORE., is to be lighted by electricity generated at the 2000-hp electric plant now being constructed by the Wasco Warehouse & Milling Company. The new plant, which will be installed at the company's new flouring mills on White River, 26 miles from The Dalles, will probably be ready for operation Dec. 1. The mills will be operated by electric power.

LANCASTER, PA.—The Lancaster County Railway & Light Company has awarded the contract for additions to its power plant, which, when completed, will make it the largest plant of its kind in the State.

GEORGETOWN, S. C.—It is reported that a Philadelphia firm has purchased the Georgetown electric light plant.

SALT LAKE CITY, UTAH.—The Pocatello Water Company is repiping the water conduit in the hills, and building a large dam on Mink Creek. It is thought that this dam will be used in the near future for the much talked of municipal lighting plant for Pocatello, Idaho.

THE ELECTRIC RAILWAY.

SAN FRANCISCO, CALIF.—The Del Monte, Monterey & Pacific Grove Electric Railway Company was recently incorporated. Monterey is the principal place of business. Directors: J. D. Carr, Charles Carr, J. P. Sargent, H. R. Robins and R. F. Johnson. Capital stock, $200,000; subscribed, $5,000.

DENVER, COLO.—With a capitalization of $500,000 the Great Western Railway Company has filed articles of incorporation at Denver. The incorporators are Charles Boettcher, S. D. Willing, J. C. Buck, William Byrd Page and C. S. Morey, of Denver; J. R. McKinnie, of Colorado Springs, and John F. Campion of Leadville. The road will be built from Loveland to Berthoud, and later from Loveland into Denver. Work will be begun as soon as bids can be prepared and accepted, and, it has been determined to use electric power.

HARTFORD, CONN.—The Connecticut Railway & Lighting Company is purchasing land along the survey of its proposed road from Waterbury to Southington, and it is understood that the construction of the line will be undertaken early in the spring.

ATHENS, GA.—The Athens Electric Street Railway Company has executed a deed of trust to cover a bond issue of $400,000. Two hundred thousand dollars is to be taken up now; $100,000 for the present bonded indebtedness and $100,000 to complete the development of Tallulah shoals and the equipment of a larger power plant.

EDWARDSVILLE, ILL.—The controversy between the Litchfield and Madison Railway and the Mississippi Valley Electric Railway has been settled. The latter has been barring the street car line out of Edwardsville by maintaining a patrol of four locomotives at the crossing point.

MORGANTOWN, IND.—There is a field here for an electric railway.

KOKOMO, IND.—The Union Traction Company has entered a petition for a franchise for an electric railway through this city. The line will run from Kokomo to Indianapolis.

ELKHART, IND.—James F. Rothwell, of St. Louis, was granted a franchise Oct. 29, to build an electric railway along highways from Goshen through the southern quarter of the county.

INDIANAPOLIS, IND.—The Franklin & Indianapolis Electric Railway Company has been incorporated, with a capital stock of $50,000. The purpose of the company is to build a railway between Indianapolis and Frankfort, a distance of 47 miles.

SIOUX CITY, IA.—The promotors of the proposed electric railway from Sioux City to Le Mars have enlarged their plan, and now propose to construct the line to Spirit Lake. The total length of the road will be ninety miles.

LEXINGTON, KY.—Ex-Senator Davis is interested in an enterprise having for its purpose the building of an electric railway system and establishing related industries, with Lexington as the centre. It is stated that the Blue Grass Rapid Transit Company will be organized for the purpose of carrying out the plans, and will have a capital of $7,000,000.

BOSTON, MASS.—The Old Colony Street Railway Company, one of the sub-companies of the Massachusetts Electric Company, has been substituting aluminum feeder cables for copper.

BOSTON, MASS.—The Boston & Maine has asked the New Hampshire Railroad Commissioners for authority to issue $500,000 bonds to build the Concord, Manchester & Nashua Electric Railway.

LANSING, MICH.—The Battle Creek & Marshall Traction Company, with $200,000 capital, has filed articles of incorporation with the Secretary of State.

NATCHEZ, MISS.—The contract has been let for the iron and a large part of the material for the Natchez Electric Railway. Preparatory work will be started as soon as engineers reach the city.

HARTVILLE, MO.—The citizens of Ava, Douglas County, have taken initiatory steps toward connecting their town by an electric railway line with Cedar Gap, Wright County. Local capitalists will take the stock of the Ava Northern Railway Company. The following directors were elecetd for the ensuing year: S. B. West, J. H. Murray, W. J. Turner, M. C. Reynolds, J. M. Adams, A. H. Buchanan, B. J. Smith, H. S. Wilson and J. A. G. Reynolds. W. J. Turner was elected president, J. H. Murray vice-president, J. A. G. Reynolds treasurer, H. S. Wilson secretary and A. H. Buchanan, auditor.

HENDERSONVILLE, N. C.—It is rumored that an electric railway may be built from the town of Hendersonville to Flat Rock, N. C.

ALBANY, N. Y.—The State Board of Railroad Commissioners has granted permission to the Rochester & Eastern Rapid Railway Company, incorporated in 1900, with a capital of $500,000, to construct and operate an electric railway 40 miles long from Rochester to Geneva, with a branch from Pittsford to Fairport.

ALBANY, N. Y.—The Subway & Suburban Construction Company, of New York City, has been incorporated, with a capital of $300,000. It is proposed to construct railways and to do work incidental thereto. The directors for the first year are Frank V. Ainslie, of Brooklyn, and Emile Dreyfus, William F. McCombs, Jr., Dunbar Hunt, and Henry D. McGowan, of New York City.

ALBANY, N. Y.—The Orange County Traction Company, a reorganization of the Newburg Electric Railway Company, has been incorporated, with a capital of $325,000. The directors are F. H. Moffatt, of New Brighton; L. H. Clark, F. H. Pouch, P. D. Pouch and B. J. Bloodgood, of Brooklyn; A. B. Pouch, of Tompkinsville; J. B. Kilsheimer, of New York City; E. O. Alyea, of Newark, and W. C. Hascey, of Montclair, N. J.

AKRON, OHIO.—The Northern Ohio Traction Company has applied for a franchise in Akron.

CIRCLEVILLE, OHIO.—The village of Circleville has established two street railway routes through the town and proposals have been called for.

CINCINNATI, OHIO.—The Mansfield, Savannah & Wellington Electric Railway Company recently increased its capital from $100,000 to $1,500,000.

COSHOCTON, OHIO.—The Newark, Zanesville & Coshocton Railway has been granted a franchise in Coshocton enabling it to enter the center of the town.

ASHLAND, OHIO.—The Norwalk, Ashland & Southern Railway Company announces that all right of way has been secured, and that construction work will start early in the spring.

TOLEDO, OHIO.—A. K. Detwiler, George Detwiler, George Metzger, Irving Squire and other well known promotors have taken up the project of a line from Toledo to Ypsilanti, Mich.

CONNEAUT, OHIO.—Power has been turned on at the power-house of the Pennsylvania & Ohio Railway at Conneaut. The road will be in operation between Conneaut and Ashtabula within a few days.

SIDNEY, OHIO.—The Western Ohio Railway Company has agreed to post a forfeit of $15,000 with the Sidney Board of Trade to insure the building of its road between Loramie and Sidney within 26 months.

DAYTON, OHIO.—President Valentine Winters, of the Dayton & Western Traction Company, has applied to the county commissioners of Preble County for a franchise to extend the road to Richmond, Ind.

MARIETTA, OHIO.—The Washington Traction Company, of Marietta, has been incorporated, with $250,000 capital stock, by Ralph J. Sensor, Rufus Underwood, D. H. Buel, Willis Morris, and John H. Reilley.

PAINESVILLE, OHIO.—P. W. Tuttle, C. W. Goodrich, C. E. Barnum and F. S. Turner, of Geneva, promoters of a line from Ashtabula to Painesville, have applied to the Lake County Commissioners for a new franchise.

CLEVELAND, OHIO.—Thomas W. Latham, D. A. Dangler, D. H. Kimberley and others have completed a deal for the purchase of franchises and right of way of a company organized some time ago at Wabash, Ind., to build a line from Wabash to Rochester, thirty-four miles.

CLEVELAND, OHIO.—The Collinwood Council has granted the Cleveland Electric Railway a franchise to extend its line to Nottingham. The company agreed to carry passengers to the Public Square, Cleveland, a distance of 12 miles, for five cents. The franchise is for twenty-three years.

STEUBENVILLE, OHIO.—It is stated that the Steubenville Traction Company and the Steubenville, Mingoe & Ohio Valley Traction Company are soon to be absorbed by the Philadelphia Company of Pittsburg, with a view to forming part of a system which will extend from Wheeling, W. Va., to Pittsburg.

CINCINNATI, OHIO.—The Cincinnati, Blanchester & Columbus Electric Railway Company, of Blanchester, has been incorporated, with $10,000 capital stock. The incorporators were E. D. Smith, Roy J. Rice, H. L. Day, M. V. Whitacre, Fred. C. Rice, D. W. Hogan, all of Blanchester, and Simeon G. Smith, of Wilmington.

CLEVELAND, OHIO.—The Lake Shore Electric Railway has purchased a private right of way several miles in length near Woodville which will be graded and track laid as soon as possible. This eliminates one of the worst curves on the Toledo, Fremont & Norwalk division, besides giving private right of way and saving time.

CLEVELAND, OHIO.—Prominent Cleveland people have pledged themselves to subscribe $1,115,000 for the purpose of building two electric street railways in this city to be operated on a three-cent fare basis and with universal transfers, to compete with the present companies. Mayor Johnson denies that he has any connection with the roads.

CLEVELAND, OHIO.—The Lake Shore Electric Railway Company is arranging with the theatre managements in Cleveland, Sandusky, Fremont and Toledo, to advertise in the surrounding towns the theatre attractions to be given in these centers, and to provide special theatre cars which will carry people direct to and from the places of amusement.

TOLEDO, OHIO.—The recently organized Everett-Moore Managers' Association met in Toledo a few days ago. Plans for the adoption of certain types of interurban and city cars, as standard, were discussed, and such cars will be designed to be used on all the various city and interurban roads owned by the syndicate, thereby making it possible to buy in quantities and reducing the cost of maintenance.

COLUMBUS, OHIO.—The Columbus, Grove City & Southwestern Railway has brought an injunction suit against the Franklin County Commissioners to restrain them from carrying out their threat of annuling a portion of the Grove City franchise leading into Columbus. Another company is now securing consents of property owners along the same route with a view to ousting the Grove City company.

CLEVELAND, OHIO.—The report comes from Canton that the Everett-Moore syndicate has closed a deal for the purchase of the city lines in Canton and the Canton-Massillon Railway, which are owned largely by Hon. W. A. Lynch, of Canton. The original price asked for the property was $1,000,000, but this was more than the syndicate would pay for the twenty-five miles of road and it is stated that they have finally agreed upon $700,000.

CINCINNATI, OHIO.—The Ft. Wayne, Dayton & Cincinnati Traction Company, which is projecting one of the longest electric railways in the country, extending from Ft. Wayne to Cincinnati, has secured control of the Cincinnati & Westwood Railway (steam) which extends almost to the center of Cincinnati, thus affording private right of way to the city. The officers of the company are: Dr. S. F. George, Dayton, president; D. W. LaFetra, New York, vice-president; C. L. Hyde, Pierre, S. D., second vice-president; C. W. Gebhart, Dayton, secretary-treasurer.

CLEVELAND, OHIO.—The Everett-Moore syndicate has purchased at Toledo a large tract of land adjoining its present freight station on Huron Street, and will erect a fine office building and terminal station for the interurban roads entering Toledo. It is also the intention to soon erect a large plant which will be utilized as machine and repair shops, paint shop, etc., for the city lines, the Detroit & Toledo Shore Line, the Toledo & Maumee Valley and the Western division of the Lake Shore Electric Railway. Eventually similar shops will be erected in Cleveland and Detroit.

TORONTO, ONT.—The Toronto Electric Street Railway carried during the week when the Duke and Duchess of York were in Toronto, no less than 1,200,000 passengers, not counting transfers. During one day of that week 282,000 people were carried.

PORTLAND, ORE.—The City & Suburban Railway Company's East Side electric power plant in Portland will soon have its capacity increased to 3,000 horse-power. A 1200-hp direct connected generator and Corliss engine and additional water tube boilers are now being installed. Condensers and pumps are included in the new apparatus, which will increase the economy of operation.

YORK, PA.—The York & York Furnace Traction Company, soon to be chartered, with a capital of $420,000, has planned a trolley line from York parallel with the Pennsylvania & Maryland Railroad through several prominent towns in this section.

NEW CASTLE, PA.—The Sharon & New Castle Railway Company announces its intention of at once beginning the construction of the line from Sharon to this city. To this end the company has just negotiated a loan of $500,000, which was placed with the New York Security & Trust Company.

EBENSBURG, PA.—The building of the street car line from Ebensburg to Johnstown, recently projected by the Conemaugh Valley Street Railway Company, is now assured, and will probably be commenced soon. The company is already chartered and the capital stock all subscribed by Philadelphia and Johnstown men.

SCRANTON, PA.—A charter has been granted to the Berwick & Nanticoke Electric Railway. The road will connect Berwick, Beach Haven, Hicks Ferry, Shickshinney and Nanticoke, and will pass through a rich farming district. The right of way has been secured along the greater part of the route, which is twenty miles in length. The officers are: President, C. W. Miller; Treasurer, L. E. Waller; Secretary, C. C. Peacock, Bloomsburg; Directors, C. M. Creveling, Almedia; C. H. Campbell, Briar Creek; F. E. Miller, C. W. Miller, C. C. Peacock and L. E. Waller.

MONTREAL, QUE.—At a meeting of the Board of Directors of the Montreal Electric Street Railway, held Oct. 23, the annual statement for the year ending Sept. 30 last was submitted. During the year the company's earnings amounted to $1,888,967. In dividends, the street railway paid out the sum of $551,700. There was transferred to the contingent account the sum of $50,000. There was also transferred to the surplus account the sum of $47,551. The income of the Montreal Street Railway, over and above expenses and fixed charges, exclusive of dividends, amounted to $649,251, as compared with $647,246 for the year 1900.

KNOXVILLE, TENN.—Mr. W. T. Goffe, of Toronto, Canada, announces that Canadian capital will build an electric line from Knoxville, Tenn., to Sevierville, Tenn. The line will be 48 miles long.

SPOKANE, WASH.—The Chelan Transportation & Smelting Company, now building a smelter on the Columbia, near Lake Chelan, and building a railroad from the lake to the Holden mines, has secured a 40-year franchise for the construction of an electric railway from Lakeview to the Columbia River, where the smelter is located.

EDUCATIONAL.

MICHIGAN STATE AGRICULTURAL COLLEGE.—The 1900-1 catalogue of the Michigan State Agricultural College contains a list of officers and students for the year 1900-1, together with other general information concerning the college. This is the forty-fourth year of this institution. This college gives a course in electrical engineering, also one in mechanical engineering.

McGILL UNIVERSITY.—The mathematical laboratory at McGill University is being moved from the engineering to the physics building. The space it occupied will be used partly by the civil engineering department in extending its laboratory for testing materials, and partly by a new lecture-room, none of the old ones being large enough to hold the classes of this year. A 300-kilowatt storage battery has been installed in the engineering building, so that the building can be lighted without keeping the steam-plant running. It is charged by one of the 50-horse-power steam dynamo units, remodeled for the purpose. Several pieces of apparatus, mostly electric measuring instruments, have been given by the Canadian General Electric, the Westinghouse, and other electric companies.

THE AUTOMOBILE.

THE LONG ISLAND MOTOR COMPANY, of Brooklyn, has been incorporated to build motors, motor vehicles, and vessels; capital, $100,000. Directors: Charles Rockliff, A. R. Pardington, and F. G. Webb, Brooklyn.

BOSTON, MASS.—An official of the New England Electric Vehicle Company, says: "There is no foundation for the report that the Armstrong Transfer Company is to take over the business of the New England Electric Vehicle Company. The report probably developed from the fact that the Armstrong Transfer Company recently purchased two or three of our busses."

PATERSON, N. J.—The rapid transit service which the Passaic Auto-Transportation Company started in Passaic several months ago has been suspended. The five large machines used by the company are stored in the stables awaiting the action of the managers. For several weeks the automobiles were well patronized, but the novelty wore off, and the people refused to ride any longer, despite the fact that the fare was less than that charged by the hackmen. The cost of the Passaic plant was $12,000, while the cost of operation was $1,000 a month. The incorporators, Isaac W. England, John V. Kehoe, Charles Denholm, W. F. Gaston, and William Ryan, are the principal losers.

PHILADELPHIA CLUB PARADE.—The second annual parade and review of the local automobilists under the auspices of the Philadelphia Automobile Club was held on the afternoon of Nov. 2, the line of parade starting from Broad and Walnut Streets shortly after 3 o'clock. It was expected that there would be a large turnout of automobiles, but the display, for some unexplained reason, fell far short of last year's parade. There were only thirty-four machines in line, including all the various makes of vehicles, steam, electric and gasolene, steam and electric seeming to predominate. Most of the vehicles were of the runabout type, carrying two persons, although many were built to carry four. The parade was in charge of a committee of members of the Philadelphia Automobile Club, consisting of Messrs. Henry J. Norris, John L. Wilson, Herbert M. Warden, Captain John S. Muckle, J. Maxwell Bullock, H. Bartol Brazier, Nathan Baird, Jr., and Frank C. Lewin. Captain Muckle acted as marshal, and Messrs. Brazier and Bullock were his aides.

OBITUARY.

MR. JOSEPH VIRAG, inventor of a fast telegraph system, with Mr. Pollak, is reported from Budapest, Hungary, to have died there at the age of only 31 after an illness of three days. The system attained a speed of over 70,000 words per hour, and has been tested in this country.

PERSONAL.

MR. C. R. CRANE, vice-president of the Crane Company, of Chicago, has just returned from an extended trip to Europe, where he recently went in the interests of the company.

PROF. G. F. SEVER, of Columbia University, superintendent of electrical exhibits at the Pan-American Exposition, has been presented with a handsome gold watch by a number of the exhibitors in Electricity Building.

MR. JOHN MARTIN, of John Martin & Company, the Stanley Electric Manufacturing Company's California representative, was at the Waldorf-Astoria during the past week, accompanied by Mr. Henry Hine, now of Colorado, but formerly so prominent in the company's affairs.

MR. CHAS. R. HUNTLEY, general manager of the Buffalo General Electric Company, has become a director in the new Electrograph Company of America, just formed in Cleveland to exploit the Palmer electrograph, which has already been described and illustrated in these pages.

MR. A. V. ABBOTT has in the October journal of the Western Society of Engineers a very interesting paper presented a few months ago, on electrical oscillations of high frequency. It is an admirable, popular presentation of the subject and is illustrated with several half-tones and diagrams.

MR. J. G. WHITE, the well known electrical engineer, and president of J. G. White & Company, is now on a trip home from London, and expects to spend a month or two in this country before returning to England, where he has become engaged in various important enterprises.

MR. ANTHONY N. BRADY, who is so prominent in lighting and other enterprises, rarely breaks silence, but he has a pithy little article in the *North American Review* for November on "The Services of Electricity," in which he sums up the development of electrical applications and points out their growing magnitude.

MR. G. H. KOHLER, superintendent of works of the Union Elektricitäts Gesellschaft, Berlin, is in this country on a trip of investigation, during which he will probably purchase some of the latest machine tools. He will visit all the recent plants in lighting, railway work, etc. Mr. Kohler is familiar with American practice and is a graduate of Lehigh.

MR. CHARLES W. MORSE, of the Telephone, Telegraph & Cable Company, is said to have his plans completed for a telephone service in New York City which will cover the entire field, and to expect to have subscribers there within six months. That is not quite the same thing, however, as giving service, but activity is also promised in that direction.

MR. PHILIP G. GOSSLER has, it is stated, been elected general manager of the Royal Electric Company, of Montreal, Canada, with a salary of $12,000. He has for some time past been actively engaged in connection with the enterprise as electrical engineer, etc. He is a member of the American Institute of Electrical Engineers, and is well known in this country.

MR. M. C. SULLIVAN, the electrical engineer and contractor who has given considerable attention to signal service work, is corporal in the First Signal Corps of the National Guard of New York State. Last week he received the championship medal decoration for 1900 for the corps, won by his work ranging from field line construction through the whole line of signal drill and operation.

DR. F. A. C. PERRINE, we learn, is on the Pacific Coast, and it is hoped that it will be feasible for him to go up into the mountains and view some of the splendid work which he personally and the Stanley Company have done so much to render possible. Dr. Perrine was consulting electrical engineer of the great Standard Company, of California, prior to his incumbency as president of the Stanley Electric Manufacturing Company.

MR. CHAS. W. PHIPPS, a pioneer in the Brush electric light industry and for some years connected with the General Electric Company has been sent by that concern to England, where he will have a prominent position in the management of the new shops at Rugby. Mr. Phipps is English by birth, and it is understood he will stay in his native country. He has a great many warm friends in the United States who regret his departure.

MESSRS. L. B. STILLWELL, the electrical engineer, and his assistant, Mr. John Van Vleck, the mechanical engineer of the Rapid Transit Commission, have just returned from Europe after a tour of inspection of underground roads there. Other members of the party abroad were Messrs. J. B. McDonald, the contractor; Mr. E. B. Bryan, who may operate the road, and Mr. W. B. Parsons, the chief engineer of the Commission. Messrs. Stillwell, Van Vleck and Bryan visited also the works of Brown, Boveri & Company at Baden, Switzerland, and the Ganz three-phase road at Lecco, Italy.

MR. R. R. BOWKER, formerly first vice-president of the Edison Electric Illuminating Company, of New York, and editor of the *Publishers' Weekly*, has a slashing article in the October *Atlantic Monthly* entitled, "The Piracy of Public Franchises," but devoted chiefly to a discussion of the manner in which the stocks and bonds of the "public service" companies of New York have been watered, under the Whitney-Brady regime. Mr. Bowker expresses his opinion quite frankly against the methods by which, according to him, the obligations of these properties have been carried far beyond the proper point.

Trade Notes.

MR. FRANCIS RAYMOND, the manufacturer's agent, Chicago, announces his engagement to Miss Louise Norfleet Black, of Hyde Park, Ill.

CROSS OIL FILTERS.—Two important orders of Cross oil filters are on their way from the Burt Manufacturing Company, of Akron, Ohio, to help German manufacturers cut down their oil bills.

PRESIDENT ROOSEVELT.—The November calendar of the Bullock Electric Manufacturing Company, Cincinnati, Ohio, is of very handsome design in gold and colors. It is of a patriotic nature and contains a medallion of President Roosevelt.

THE ELECTRIC APPLIANCE COMPANY, Chicago, has been caught in the act of "pointing with pride" to its No. 36 cabinet type wall telephone. It is made in several styles which are described in the circular it is now sending out to the trade.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, reports that it has an unusually large demand for its new type Peerless incandescent lamp. It is sold under the very strongest guarantees, and the company is always glad of an opportunity to submit sample lamps for test.

THE CENTRAL ELECTRIC COMPANY, Chicago, has published a new price-list dated Nov. 1, which is devoted exclusively to the telephone trade. It includes telephones, telephone parts, batteries, and various other supplies. Any one desiring a copy can obtain the same by addressing an application to the Central Electric Company.

REVISED PRICE LISTS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued revised price lists No. 61, 66, 70 and 70A, of reversible controllers for electric cranes and hoists, reversible drum controllers, self-starters for non-reversible motors operating belted elevators, pumps, etc., and self-starters for electric elevators.

G. I. APPARATUS.—Recent bulletins of the General Incandescent Arc Light Company, 572 First Avenue, New York City, relate to high-tension circuit-breakers, enclosed arc lamps, water-tight floor outlet box, and the new panel board with removable enclosed fuse carrier, which was described and illustrated in a recent issue of ELECTRICAL WORLD AND ENGINEER. Each bulletin is illustrated.

ACTON VALVES.—Mr. John Acton, 118 John Street, Brooklyn Borough, New York City, has issued a 32-page pamphlet describing and illustrating the Acton special valves manufactured by him. These goods include reducing valves for all kinds of service, relief valves, thermostats, boiler check valves, filter and oil collector, safety valves, steam traps, water separator or grease extractors, etc.

THE JAEGER MINIATURE LAMP MANUFACTURING COMPANY, New York City, has found it necessary, owing to the continual increase of business, to enlarge its plant so as to produce 1000 lamps per day. This, its anniversary of one year of unbroken success, is attributed to Mr. C. T. Jaeger's unswerving efforts to produce only the highest grade of goods, and he feels deeply grateful for the appreciation shown.

HUBBELL PENDENT PULL SOCKETS.—A new socket called the Hubbell pendent pull socket is being advertised by the Central Electric Company of Chicago, as most convenient for chandeliers, wall brackets, etc., it being provided with a chain 10 inches long, in place of a key. This socket has been approved by the National Board of Fire Underwriters, and the Central Electric Company will be pleased to furnish additional information, and quote prices upon request.

THE B. F. STURTEVANT COMPANY, of Boston, Mass., has upon the press a catalogue, or, more properly, a treatise upon the Sturtevant steam hot blast apparatus and dry kilns. The process of drying is thoroughly discussed in a purely technical manner, and from this discussion are drawn manifest conclusions as to the advantages of the blower system of drying. The treatise relates principally to the drying of lumber and illustrates different forms of kilns, methods of piling, etc. It will be a valuable addition to the decidedly limited literature on this subject.

THE CLARK AUTOMATIC TELEPHONE SWITCHBOARD COMPANY, Providence, R. I., has removed its offices from the Banigan Building to the building at 15 Custom House Street, where it now has offices, shops and show rooms together. Its large new show room has been handsomely fitted. The company will install its Pan-American exhibit as soon as it arrives, extending and adding to it as the larger space at command will permit. This will enable it to show at a glance its system "from factory to installation."

THE CHRISTENSEN AIR-BRAKE.—The Christensen Engineering Company, of Milwaukee, Wis., has issued a very handsome catalogue giving a list of patrons using the Christensen air-brake. Many illustrations are used showing some of the equipments on many of the principal electric railways throughout the country, including the Boston Elevated, the Metropolitan Street Railway Company of Kansas City; Union Traction Company, of Indiana; the South Side Elevated of Chicago; Brooklyn Elevated, New York; New Haven & Hartford, and others. Illustrations are also given of the brake mechanism.

McKENZIE STOKERS.—Among prominent steam users who have adopted the McKenzie stoker may be mentioned the Chicago Edison Company, of Chicago; the Toledo Railways & Light Company, Toledo, Ohio; William J. Moxley Butterine Company, of Chicago; James S. Kirk & Company, soap manufacturers, Chicago; The Aurora, Elgin & Chicago Electric Railway Company, Batavia, Ill.; the Fulton Market Company, Chicago, and the Department of Electricity of the City of Chicago. The McKenzie Furnace Company, Chicago, also manufactures the latest improved stationary and locomotive grate bars.

A. E. G. PUBLICATIONS.—Of all the foreign electrical manufacturers the Allgemeine Electricitäts Gesellschaft stands easily first in the quality of its trade literature. In fact, the pamphlets it issues are rather technical treatises of a high order than having the character of trade bulletins. Among recent publications are one by its Chief Engineer, Herr Lasche, on the Zossen railway equipment; an account by Dr. Benischke, of protective devices for high-tension lines; a pamphlet describing and illustrating a number of polyphase plants and details of polyphase machinery, and a description of an electric wind vane. All of these publications are profusely illustrated, not only with half-tone views of machinery, but with diagrams and curves elucidating technical points.

THE VALUE OF MACHINERY.—Why is it that during the last century the number of farm workers has only doubled while the quantity and value of farm produce has multiplied by twenty? It is because labor-saving machinery and improved processes have been working their magic in the country. In "Marvels of Modern Production" (*McClure's* for November) George B. Waldron, the great statistician, says: "The wideawake Western farmer of today attaches to a traction engine half a dozen gangs of four ploughs each, with a seeder and harrow to each gang. As the engine moves forward it leaves a trail twenty feet wide of land sowed ready for the harvest. One man's work thus is worth that of twenty by the old method." And in all lines of industry, Mr. Waldron points out by figures which are startling, how wonderful is the saving of labor by modern machinery. It is, indeed, the great emancipator.

Record of Electrical Patents

UNITED STATES PATENTS, ISSUED OCT. 29, 1901.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

685,242. ELECTRIC RAILWAY; R. Arno and A. Caramagna, Turin, Italy. App. filed April 21, 1897. The contact box is made in two parts, each assuming opposite polarity when the pole of a magnet carried by the car is presented to them. Inside of the box is a Z-shaped armature hung on a shaft and adapted to be rotated when the magnet becomes energized to close the working circuit.

685,274. ELECTROLYTIC DECOMPOSING APPARATUS; Max Haas, Aue, Germany. App. filed June 14, 1900. (See page 782.)

685,278. BATTERY; G. Heidel, St. Louis, Mo. App. filed Aug. 20, 1900. A storage battery in which the containing vessel is one of the active elements, the other being located in the vessel.

685,279. SWITCH CONTROLLING DEVICE; G. H. Hill, Glen Ridge, N. J. App. filed Aug. 5, 1901. The switch comprises an actuating mechanism which locks it in its normal position against any moving force not applied at a prescribed point.

685,286. MAGNETO ELECTRIC GENERATOR; J. S. Mead, Buffalo, N. Y. App. filed March 18, 1901. The generator is provided with an adjustable device by which the circuit can be interrupted at any point desired between no current and maximum current.

685,290. SYSTEM OF ARMATURE WINDING; T. J. Murphy, Montreal, Canada. App. filed May 4, 1901. Machine wound coils so arranged that the outer span of the coils is some multiple of the inner portion, necessitating the outer span being two or more layers in width, for the purpose of easy winding and repairing.

685,295. CONTACT KEY FOR SOCKETS OF ELECTRIC INCANDESCENT LAMPS; G. H. Proctor, Somerville, Mass. App. filed May 15, 1901. Details.

685,301. TELEGRAPH KEY; C. Shirley, Brooklyn, N. Y., and J. F. Skirrow, East Orange, N. J. App. filed Aug. 6, 1901. The key can be rotated on its support so as to be operated by the right or left hand at will, and it is of such construction that it can be manipulated in the palm or other portion of the hand as well as the fingers.

685,308. CONTROLLER REGULATOR; A. D. Thomas, Keokuk, Ia. App. filed May 10, 1900. A regulator for the controller which permits the movement of the controller handle from step to step only after an enforced pause, the length of which can be pre-arranged by suitable adjustment.

685,313. ELECTRICITY METER; R. S. White, Chicago, Ill. App. filed Jan. 30, 1901. The armature of the motor is horizontally supported by means of a relatively frictionless bearing which also operates as a collecting device, and on which the armature by its weight normally seats itself, so that any tendency of the armature to move laterally will be resisted by gravity.

685,314. ELECTRICITY METER; R. S. White, Chicago, Ill. App. filed Aug. 24, 1901. A modification of the preceding patent.

685,326. ELECTRIC ELEVATOR HOISTING MECHANISM; T. W. Eaton, Chicago, Ill. App. filed March 26, 1901. The armature and shunt field circuit each contain resistances and means are provided for manipulating the resistances from the car.

685,390. PRINTING TELEGRAPH; J. E. Wright, New York, N. Y. App. filed Oct. 5, 1900. The invention is described by one of the claims as follows: In a printing telegraph instrument, the combination with a type-wheel having two rows of characters, of a printing-magnet and armature-lever, two printing-levers provided with platens adapted to print from the two rows of characters respectively, a pivoted plate carried by the armature

lever and having arms adapted to engage with the two printing levers respectively, according to the position in which said plate may be set, an escapement-wheel and a shaft therefor having pins or stops thereon adapted to set the plate in either of its two positions.

685,393. ELECTRIC BRAKE; P. P. Crafts, Boston, Mass. App. filed Nov. 30, 1900. A winding drum having an intermediate groove, a chain extending from the brakes and arranged to be wound in the groove, and flanges on either end of the drum containing the energizing-coils of magnetic clutches for engaging the drum with the axle.

685,394. ELECTRIC BRAKE; P. P. Crafts, Boston, Mass. App. filed Nov. 30, 1900. A locking device for holding the brake applied; said device is electromagnetically operated, and will automatically permit the further application of brakes beyond a given locked point.

685,426. ELECTRIC ARC LAMP; J. A. Mosher, Chicago, Ill. App. filed March 25, 1901. An arc headlight adapted to be attached to the back of the dashboard of a street car, the frame being constructed in two parts, one carrying the works of the lamp and the other the glass front, the two sections being secured together upon and to the opposite faces of the dashboard and around an aperture therein.

685,430. AUTOMATIC SYNCHRONIZER; J. Pearson, St. Paul, Minn. App. filed Feb. 19, 1901. Two or more synchronous, alternating-current machines and circuits therefor, an automatic switch to couple the same in parallel, a trip for the switch and an automatic synchronizer controlling said trip, which synchronizer is responsive only to a coincidence of phase and frequency between the currents in circuits to be coupled.

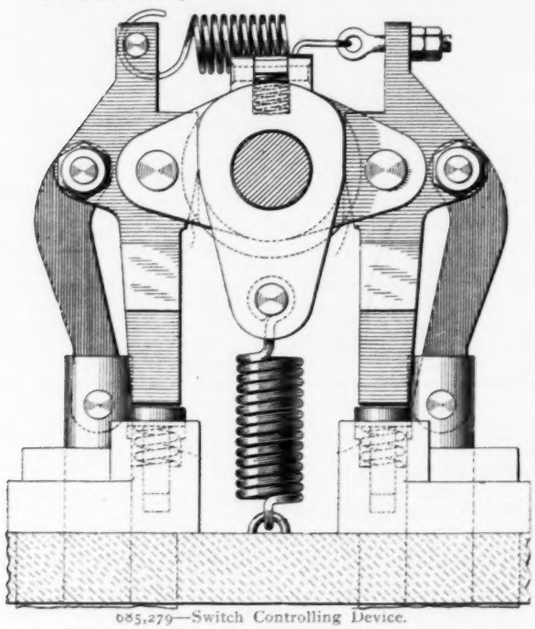
685,431. MAGNETIC DEVICE FOR USE IN ALTERNATING CURRENT CIRCUITS; J. Pearson, St. Paul, Minn. App. filed Feb. 19, 1901. A main magnet and its armature lever, a minor magnet acting on said armature in opposition to the main magnet, whereby the armature is held in engagement with the minor magnet until the main magnet attains a predetermined strength.

685,461. PROCESS OF MAKING PRINTING SURFACES; Claude A. O. Rosell, New York, N. Y. App. filed May 12, 1900. (See page 783.)

685,462. PROCESS OF MAKING PRINTING SURFACES; Claude A. O. Rosell, New York, N. Y. App. filed Nov. 4, 1898. (See page 783.)

685,470. WINDING FOR ELECTROMAGNETIC SPOOLS OR COILS; J. A. Heany, Philadelphia, Pa. App. filed Oct. 18, 1900. Bare wire is wound alternately with asbestos cord and layers of asbestos are interposed between the layers of wire.

685,471. THERMO-ELECTRIC COUPLE; Eugene Hermite and Charles Friend Cooper, Paris, France. App. filed Feb. 23, 1901. (See Current News and Notes.)



685,279—Switch Controlling Device.

685,472. PROCESS OF MANUFACTURE COPPER-SULFID RODS FOR THERMO-ELECTRIC COUPLES; Eugene Hermite and Charles Friend Cooper, Paris, France. App. filed Feb. 23, 1901. (See Current News and Notes.)

685,485. RHEOSTAT; T. S. Perkins, Idlewood, Pa. App. filed Nov. 9, 1900. Details of construction.

685,486. CONTROLLING SYSTEM FOR ELECTRIC LAMP HEATERS; Henry Noel Potter, Gottingen, Germany. App. filed Aug. 9, 1899. (See page 783.)

685,487. BALLAST CUT-OUT FOR ELECTRIC LAMPS. Henry Noel Potter, Gottingen, Germany. App. filed July 14, 1900. (See page 783.)

685,488. HEATER CUT-OUT FOR ELECTRIC LAMPS; Henry Noel Potter, Gottingen, Germany. App. filed Aug. 15, 1900. (See page 783.)

685,494. SYSTEM OF ELECTRICAL DISTRIBUTION; Norman W. Storer, Edgewood Park, Pa. App. filed Sept. 6, 1900. (See Current News and Notes.)

685,501. DESK OR TABLE LAMP; Alexander Jay Wurts, Pittsburg, Pa. App. filed Feb. 21, 1900. (See page 783.)

685,507. SWITCH FOR ELECTRIC CIRCUITS; H. P. Davis, Pittsburg, Pa. App. filed Nov. 9, 1900. A switch for electric circuits comprising two blades pivotally supported a distance apart approximately equal to their individual length so as to be moved in parallel planes through an angle of approximately one hundred and eighty degrees and stationary contact-terminals respectively in alignment with said blades.

685,512. METHOD OF TREATING NERNST LAMP GLOWERS; Marshall W. Hanks, Pittsburg, Pa. App. filed April 24, 1900. (See page 783.)

685,516. MOUNTING AND DRIVING DYNAMOS ON CARS; P. Kennedy, Brooklyn, N. Y. App. filed Feb. 5, 1901. The tension of the spring belt tightener is maintained constant by an equalizer.

685,528. HEATING DEVICE FOR ELECTRIC LAMPS; Henry Noel Potter, Gottingen, Germany. App. filed Sept. 11, 1899. (See page 783.)

685,549. ELECTRIC CUT-OUT; Alexander Jay Wurts, Pittsburg, Pa. App. filed April 17, 1901. (See page 783.)

685,571. TELEGRAPH OR OTHER SYSTEM; J. Burry, Fort Lee, N. J. App. filed Oct. 23, 1899. Details including a circuit breaker and connector comprising two metal terminals and a series of springs each fast to one of the terminals and normally bearing against the other, whereby the circuit through the breaker may be broken by forcing the springs one after the other away from the terminal each bears against, and may be made in the reverse manner.

685,575. ELECTRIC RAILWAY TROLLEY; E. R. Coon, Burlington, Va. App. filed May 25, 1901. The trolley is a sphere of conducting material, suitably mounted on the end of a pole and capable of rotating in all directions.

685,577. APPARATUS FOR REGULATING ELECTRIC GENERATING SYSTEMS; A. De Dion and G. Bouton, Puteaux, France. App. filed June 4, 1901. An arrangement by means of which the speed of the engine is regulated by the dynamo, so as to insure a constant difference of potential at its terminals, the dynamo acting on the eduction valve of the explosive engine so as to vary its speed.

685,590. ELECTRICAL INDICATOR; H. Faltermayer and E. W. Faltermayer, Philadelphia, Pa. App. filed July 19, 1900. An indicator for weather vanes in which a commutator is traversed by an arm carried by the vane and thus closes circuits leading to various magnets at a distant point which move an indicator in accordance with the motions of the vane.

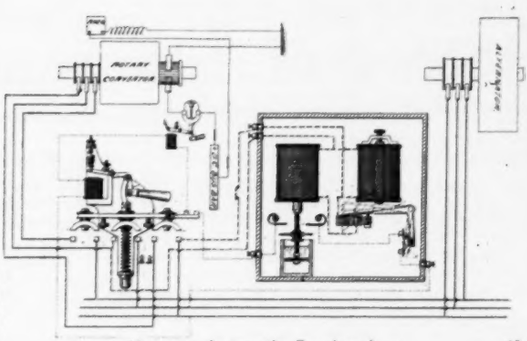
685,604. ELECTRIC SWITCH; J. W. Hearn, Brooklyn, N. Y. App. filed Jan. 27, 1901. Details of construction of an electric railway switch operating device.

685,613. SWITCHBOARD AND FUSE BOX; M. H. Johnson, Utica, N. Y. App. filed March 26, 1900. Details of construction.

685,614. SUPPORT FOR ELECTRIC PUSH BUTTONS; H. F. Keil, New York, N. Y. App. filed Feb. 13, 1901. A sheet-metal base having a thread to receive a sheet-metal cap for the button.

685,645. WATER PURIFIER; John F. Rose, Brooklyn, N. Y. App. filed July 8, 1901. The water to be purified passes through a trough, the opposite sides of which are insulated from each other and connected to the two poles of an electrical circuit; the sides contain projecting legs or teeth.

685,717. ELECTRIC FURNACE; Oscar Frolich, Steglitz, Germany. App. filed Sept. 27, 1898. (See page 782.)



685,430.—Automatic Synchronizer.

685,575.—Electric Railway Trolley.

685,720. ELECTRIC FAN; G. C. Hawkins, Boston, Mass. App. filed Jan. 24, 1901. Details.

685,724. METHOD OF ELECTRIC LIGHTING; Walter Nernst, Gottingen, Germany. App. filed April 23, 1898. (See page 783.)

685,725. ELECTRIC GLOW LAMP; Walter Nernst, Gottingen, Germany. App. filed April 28, 1898. (See page 783.)

685,726. ELECTRIC LIGHTING APPARATUS; Walter Nernst, Gottingen, Germany. App. filed April 28, 1898. (See page 783.)

685,727-8. ELECTRIC GLOW LAMP; Walter Nernst, Gottingen, Germany. App. filed April 28, 1898. (See page 783.)

685,729. GLOWER FOR ELECTRIC LAMPS; Walter Nernst, Gottingen, Germany. App. filed Aug. 24, 1899. (See page 783.)

685,730. MATERIAL FOR ELECTRIC LAMP GLOWERS; Walter Nernst, Gottingen, Germany. App. filed Aug. 24, 1899. (See page 783.)

685,731. BALLAST DEVICE FOR ELECTRIC GLOWER LAMPS; Walter Nernst, Gottingen, Germany. App. filed Sept. 29, 1899. (See page 783.)

685,732-3. GLOWER FOR ELECTRIC LAMPS; Walter Nernst, Gottingen, Germany. App. filed Aug. 24, 1899-Nov. 8, 1900. (See page 783.)